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Mrs Morgan might be right...

The Glass Container-acceptance Testing Service will find out

The frustrating thing about developing a new pack is that when you have used all the marketing experience, all the know-how, there still remains an element of chance. You never can be sure about a pack until it has been submitted to the criticism of Britain's 37 million packaging experts – the Mrs. Morgans, the consumers. You may have guessed right or wrong. Not far wrong maybe – just wrong enough to make all the difference. The maddening thing is that if you ever do discover what the Mrs. Morgans didn't like, it probably turns out to have been some footling thing that shouldn't logically have made any difference. That's the trick – consumers don't have to be logical – they don't even *have* to be consumers if they don't like your pack.

It is to remove some of this guesswork from pack development, that Britain's Glass Manufacturers have set up the Container-acceptance Testing Service. This provides Packers with facilities to test consumer reaction to new packs *before* they go into mass production. Designs can be tested in any or all of the following four progressive stages.

1 Design Preference Testing. Any new design can be tested on a consumer panel of 400 households. Their preferences will be analysed and presented to the Packer as a report and recommendation.

2 Container in Use Testing. The new container and its product can be tested in actual use in the home. The panel's experience of the new pack will be recorded, analysed and furnished as a report.

3 Shelf Testing. The sales appeal of a new pack can be tested under real store conditions, on the shelves of self-service or other stores. The speed and volume of off-take will be audited and analysed by type of store and locality. The new pack may be tested either alone or against any alternative.

4 Area Test Marketing. It was felt that facilities to convert shelf testing into a test marketing operation would be welcomed by some Packers. To make this possible an expertly staffed marketing service has been established which will plan, organise and, if desired, execute test marketing campaigns in their entirety for Packers launching new glass packed products.

Free Service. Because the glass manufacturers believe that these services should be used as widely as possible, all the facilities under headings 1, 2 and 3 are offered *free* as a service to the packing industry. The only cost to the Packer under these headings will be in the supply of goods, containers and such items as labels and transport. In the case of Area Test Marketing schemes however, a nominal charge will be made for planning the operation.

Security. Where any of these tests are carried out on new products, the whole operation can be executed with absolute security. Packers can have complete anonymity by employing one of the several brand names that have been registered especially for this purpose.

If you would care to have further details of this service, please do not hesitate to ask, irrespective of whether your interest is immediate or not. Your Glass Container Manufacturer will be happy to discuss your problem and to help you in any way. Details of this scheme have been published as a booklet, copies of which are available on request from your Glass Manufacturer or from the Federation.

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Topics and Comments

Tan without sun

THE new "sun tan" lotions based on dihydroxy acetone which are having a spectacular sale in a summer conspicuous for its lack of sunshine, are quite different from conventional tanning preparations. They do not promote tanning like creams and oils nor potentiate the effect of the sun like methoxsalen tablets. They are virtually skin dyes.

Dihydroxyacetone is not a new chemical. It has been made for years and was used in medicine to treat diabetes and in chemical synthesis. Its ability to tan the skin was noted some years ago and has now been taken up enthusiastically by the cosmetic industry. The mechanism of tanning is not properly understood. It is thought to be due to a reaction between DHA and skin protein. Tanning results in hours, the intensity varying with the individual, and disappears in a few days. The lotions are colourless and non-staining but if the user perspires freely the sweat can discolour clothes.

Four lotions are being sold in Britain: *He-Tan* at 17s. 6d., *Man-Tan* at 21s. 6d., *Night Tan* at 25s., and *Positan* at 21s. 6d.

DHA is made by the fermentation of glycerol with *acetobacter* species. The overwhelmingly biggest producer in this country is the Pfizer subsidiary, Kemball Bishop and Co. They have made it for years but now, of course, production is soaring to meet the new demand. We understand that information for formulators will shortly be published by the firm.

Users of the new lotions might well think they are protected from the sun. But protection is not conferred unless the lotion contains a sun screen. DHA is a highly reactive chemical so not all screens are compatible. We understand that five have shown compatibility. They are: menthyl salicylate, *beta*-umbelliferone, iso-safrole, phenyl salicylate, and *p*-methoxy ethoxyethyl cinnamate (*Givtan* F).

Formulators would be well advised to add one of these screens to their product.

Salk in decline?

A REPORT in the *Lancet* has shattered the hopes of Dr. Jonas Salk that the vaccine associated with his name would confer 100% immunity against poliomyelitis. Dr. T. J. Geffen of the Ministry of Health, and a colleague, Dr. C. C. Spicer, reveal that during 1958 no fewer than 242 children under 15 years of age who had been injected with the Salk-type vaccine contracted poliomyelitis that year. There was no evidence that the act of injecting the vaccine was to blame, nor was there proof that the contents of the injection were culpable.

This news strengthens the case for the live vaccine. The U.S.S.R. continues to lead in the development of live vaccine which is relatively cheap and simple to prepare; 100,000 doses can be prepared from the kidney of a single monkey. The vaccine has been injected into the brain cells of monkeys and as a rule, no pathological reactions developed. By the end of 1959 twelve million children had been vaccinated in the U.S.S.R. and no cases of polio resulted from the vaccine. It is easy to administer, being taken orally in liquid or tablet form in three doses at monthly intervals.

Working in a growth industry

RE-READING the A.B.C.M.'s recruiting booklet "The Chemical Industry—a Career for You" confirms our first impression that it is attractive, factual and persuasive. The youngster who reads it will discover the difference between fine chemicals and heavy, how apparently "un-chemical" things like plastics and metals fit into the industry, how working conditions have improved, and how wide is the range of careers—from chemists to sales executives. He will discover that it is an industry of tremendous growth—output has doubled in 10 years—and of exhilarating technical change and progress.

What he will not discover is what sort of income he might expect to achieve. Admitting the difficulties of discussing money in a trade association publication, we would have thought that some indication could have been given for a few typical jobs.

A valuable feature of the booklet is the accompanying brochure in which member companies describe their activities and career opportunities. What is surprising is the large number of companies missing from the list. Every one of the 236 members was invited to appear in the brochure but only 93 accepted.

Messing about with chemicals

FOR all but the boys who embark on chemistry as a career school chemistry is a waste of time, and is so badly taught that it repels many boys from becoming chemists and instils into the others an aversion to chemistry and to things chemical. This, in essence, is the indictment published by Dr. Michael Bassey in an article called "The irrelevance of school chemistry" in the *New Scientist*. Dr. Bassey is head of the economic research unit of Fisons Pest Control Ltd. Presumably as a labour of love he recently conducted a survey at University College, London, among arts undergraduates who had studied chemistry at school. These people had studied sufficient chemistry and physics to pass the O level of the General Certificate of Examination, but had not studied science since. Their unflattering comments on chemistry are particularly interesting in view of the campaign of the Association of British Chemical

Manufacturers to attract more youngsters into the chemical industry (see MANUFACTURING CHEMIST, July, p. 315 and "Working in a Growth Industry").

Among other questions, the undergraduates were asked whether they had been taught about aspirin, DDT, Lavoisier, phlogiston and the Law of Multiple Proportions. Lavoisier came top of the poll, phlogiston and the Law of Multiple Proportions came second, and DDT and aspirin "would have lost their deposits in an election." This is the crux of Dr. Bassey's complaint. Chemistry seems to be taught as a mass of unrelated and irrelevant facts, all right for people who enjoy messing about with chemicals and playing with beakers and Bunsen burners, but repellent to others. Little attempt seems to be made to teach of the achievements of chemistry, of the methods of scientific research, of the importance of the chemical industry and of its major products. So the opportunity is lost of creating wonderment and interest in an industry that employs half a million people and which is fundamental to our very existence. Perhaps the A.B.C.M. had better start teaching the teachers.

At odds on Communist trade

BRITAIN and the United States disagree about trading with Communist countries. The British government has progressively relaxed export regulations, and recently some large contracts have been signed between Britain and Russia for the export of processes and industrial machinery. In the U.S. there is great reluctance to sell goods to Communist countries and point-blank refusals to sell know-how and machinery. Frequently the embargo on know-how is imposed by trade associations, not the American government. For instance, the Chemical Manufacturers' Association forbids its members to sell processes and plant to the Communists.

Now the chairman of I.C.I., Mr. S. P. Chambers, has waded into the controversy. In a speech at the English-Speaking Union in London he examined the Americans' arguments against trade with the Communists. First they say that trade builds up an unfriendly competitor. This argument has substance, but it is equally valid for countries like Japan which, if they are built up to high technical standards, have an enormous advantage in export markets because of low wage costs. Mr. Chambers thought that the long-term advantages of building up the living standards of Japan, Poland, Russia, etc., enormously outweighed the short-term embarrassment. I.C.I., he said, is selling know-how to the Communists, but it is convinced that the internal demand for consumer goods in those countries is so great that there is unlikely to be an export problem for many years. In any case, the free world has the weapon of import prohibition if it feels that Communist export trade has a dangerous political slant. Furthermore, trade has to be balanced and imports from the Communists would have to be balanced by exports to them.

The other argument against trade with the Communists is that by selling them plant and processes ready-made, their technical resources are freed for the development of nuclear weapons. This, thought Mr. Chambers, is a theoretical argument, for if the Russian government, for instance, wishes to make a technical break-through—such as the sputniks—this can be done at the expense of the rest of the economy. Guns before butter has always been a feasible policy in dictatorships.

Cartels again?

IN ANOTHER part of his speech, Mr. Chambers discussed the embarrassment caused to British exporters by low-cost American exports. The U.S. home market is so rich that manufacturers can afford to sell their surpluses more cheaply than competitors in countries with small home markets. He asked for an agreement between manufacturers in different countries to play fair on exports. This, of course, raises the horrible spectre of cartels. Can the Americans with their worship of competition in all forms—fair and unfair—ever bring themselves to swallow the fact that something very much like a cartel is necessary for the sake of equitable trading? Mr. Chambers thinks that it will be some time before the hard facts of international trade impress themselves sufficiently on the Americans for them to jettison their traditional hostility to cartels. This is an all-American heritage and it is not likely to die quickly, whoever sits in the White House during the next four years.

Acetic acid from oil

ALL classical routes to acetic acid (apart from the acetic fermentation process) involve the oxidation of acetaldehyde, which is itself derived from acetylene, ethylene or ethanol. These materials have been produced either from coal or by fermentation, and nowadays are made in modern petroleum chemical operations from hydrocarbons. A new process developed by the Distillers Co. is unique in that it achieves the direct production of acetic acid from the same basic readily available petroleum hydrocarbons which are commonly used today for producing acetylene or ethylene, thus avoiding the isolation of these intermediates. Acetic acid has already been produced by the direct oxidation of relatively pure hydrocarbons, notably on a very large scale in the United States from butane, but the Distillers' project is, so far as is known, the first in the world to use a relatively cheap mixed hydrocarbon feedstock. The yield of acetic acid is said to be sufficiently high to lead to an attractive and economic process, in spite of rather high capital cost.

The acetic acid which is the main product of the process can be made to the very strict specifications demanded today, and the suitability of the acid for all major industrial requirements on the one hand, and for edible requirements on the other, has been confirmed by extensive trials with bulk quantities.

In the process, minor amounts of formic, propionic and succinic acids are also produced.

The original concept of the process arose out of the extensive programmes of research into the chemistry of the oxidation of hydrocarbons, which have played a prominent part for many years in the work of the central D.C.L. research and development department. Following the encouraging results of initial laboratory explorations at Epsom, Surrey, the process was further developed there by investigation in semi-technical equipment, before being translated into a fully integrated pilot operation at the department's pilot plant at Tonbridge, Kent.

The pilot plant was operated under automatic control for long periods in order to study the process variables, special equipment design, potential corrosion difficulties and (perhaps the most important of all) product quality, under operating conditions. During the course of this work problems were indeed encountered, but proved to be capable of satisfactory solution. For example, it was found that, by proper choice of operating conditions, the need for unusual materials of plant construction could be avoided.

Following the completion of the pilot plant programme, the full-scale process design for the new £2 million plant at the Hull works of Distillers was prepared in detail by the research and development department in collaboration with the D.C.L. engineering division and with the D.C.L. chemical division, which is to operate the Hull plant. The Lummus Co. Ltd., London, has been awarded the main construction contract.

Fragrance and the male

THE latest figures that can be considered at all accurate (1958) indicate that the American public spent $94 million on men's "luxury fragrance items." These include after- and pre-shave lotions, talcs and colognes, and packaged toiletries. It does not, however, include the $69·85 million spent on shaving essentials, namely soaps, sticks and creams of all kinds. Furthermore $121·75 million was spent on all so-called shaving preparations as against $120·9 million spent on all fragrance preparations including women's products, $10 million for men's colognes and $33 million for men's packaged toiletries.

The success of the sales at the moment is due to the functional properties of these goods. It would be folly to admit to any male that the fragrances he uses are virtually interchangeable with those worn by women despite the masculine container, the he-man design in the art work and the military and executive names.

But then the question is, what is a feminine perfume and what is a masculine fragrance? Is one feminine because women always wear it, and must the other always smell like pine, leather or fern?

It is probably more true to say that the whole point is one of association of ideas combining the name of the product, the sales talk and the skill of the perfumer. Recent tests have shown that men, describing odours of their choice as manly, clean and fresh, select scents which with modifications are worn by women. So the subject remains wide open and controversial and the industry is still faced with the problem of whether any slight sign of effeminacy will affect the sales adversely.

Chemicals—with care

AT THE National Industrial Safety Conference in Scarborough recently, delegates were given an informative picture of the successful scheme operated by the Association of British Chemical Manufacturers to avoid the mishandling of chemicals due to an improper understanding of the contents of containers. Mr. W. M. Diggle, secretary of the A.B.C.M. marking containers committee, explained that in the late 1940's H.M. Factory Inspectorate expressed concern about the multitude of new chemicals they were coming across, especially in small factories and warehouses, many of which were unlabelled. It was quite rightly pointed out that, because of this, accidents happened. At about the same time that the authorities approached the Association, suggesting that something should be done about this problem, a large chemical firm had themselves become aware that here was a problem of safety and had set up a panel to consider it. The nucleus of their scheme was passed to the Association to be further developed on behalf of those members of the chemical industry represented by the Association.

The scheme has been a success. This is evidenced by the fact that practically every member firm making hazardous chemicals voluntarily applies it to its products, and the fact that, in the twelve years since the idea germinated, there has been no suggestion of legislation on this subject, legislation which might have been unwieldy and restrictive.

Before devising any scheme for warning labels such as this, three things must be clear: why the warning is necessary; to whom it is to be directed; and what is required to be said. On these three will depend the form the warning is to take.

If the scheme is to be implemented without disadvantage to any particular firm it must be uniform. Although each chemical product and its package presents a separate, though maybe a similar, problem, uniformity can be achieved through the overall design of the label and the inclusion of standard subject matter expressed in an agreed range of standard phrases which are themselves accurate, brief and expressed in simple, easily understood words.

The warning label, if it is to be effective, must be easily recognisable as such and quite distinct from other markings. The most significant aspect of any package, especially when it is first noticed, is colour. For this reason the warning labels of the A.B.C.M. scheme are black on white. White is used as the background demarcating a specified area measuring 5½ in. across and of a depth depending on the amount of wording necessary. The wording is superimposed

in black on this white background and the whole is surrounded by a black border.

In essence the operation of this scheme is simple and is done through a committee of representatives of member firms of the Association, each of whom is expert in a particular field. Manufacturers requiring a label for a particular product submit this request to the Committee, or the Committee may feel that a particular product should be labelled. In either case the Committee then contacts all manufacturers of the product, usually by correspondence but in some cases direct. By discussion, agreement is reached on the standard phrases to be used, the wording ratified by the Committee and published in the Manual.

But the work of the Committee goes beyond this. Its members have, by their contacts within their own firms and others, a close knowledge of the needs of the chemical industry in the field of labelling. These contacts extend beyond domestic chemical industry to correspondence and interchange of experience with the Manufacturing Chemists' Association of America, similar interested bodies in Continental countries and also the International Labour Office in Geneva.

Isotope economics

THE USE of radioisotopes in industry is now established practice, but many people may wonder if the high cost of preparing and using these materials is worth the benefits obtained by using them. An assessment of the advantages of using radioisotopes was attempted by Dr. J. L. Putman, acting head of the Isotope Division of the A.E.R.E., in an address at the Scottish Management Conference. He said that, leaving aside the improvements in human well-being from medical uses of these materials, much of the benefit of quality improvements from process control and non-destructive testing is passed on to the consumer. A new industry has grown around the production and supply of nucleonic instruments. Other industries are able to offer new products with which there is no past standard of reference for comparison.

Dr. Putman said that some economies in material, machine time and labour in established industries can be assessed at least approximately in terms of hard cash. A limited survey along these lines showed that industries in the U.K. saved at least £3½ million annually in the financial year 1957-58 and perhaps as much as £7 million. What was more striking was that figures indicated a potential saving four times as great if all firms in each industry adopted the methods now used by only a few. A survey made along similar lines in the United States in 1959 found estimated tangible savings of $39 million annually, a figure comparable with the British figure, considering that the United States industrial turnover is about 3¾ times as great as the U.K.

All other techniques still in the course of development could well increase potential savings to £70 million per year.

Patios, pools and pills

WE HAVE seen many beautiful pharmaceutical factories both here and in Europe, but none so lavish as the Stuart Pharmaceutical Co.'s factory appears to be from a description in the *Economist*, a paper not usually given to excessive praise. It is in Pasadena, California, an address romantic enough to awaken extravagant expectation. But even Pasadena has its drab parts, and it is because it is placed in the middle of a long row of dusty industrial sheds that the Stuart building—all white and gold amid palm trees and fountains—is as delightful as an oasis. This aquatic simile can be carried into the building, for inside there is room enough for one of the patios typical of California, with cool pools, hanging vines and ferns, globes of light at all levels, leading into an open-air swimming bath and recreation area. These amenities are enjoyed between pill making and at weekends, when the workers' families use them too.

Needless to say the country club atmosphere has drawn workers like a magnet—there's a waiting list to work there. The factory cost three million dollars, but this is said to be less than a conventionally designed plant. Even so it seems a hefty enough price for a medium-sized building, but that, perhaps, is one reason for big drug bills in America.

The advertising value of their " palace " is fully exploited by the company. They invite doctors to admire the architecture, and sell them on their products while they succumb to the charms of pool and patio. We doubt if the Minister of Health would look with favour on patio'd pill palaces, though the Minister of Housing would approve of the uplift they could give to places like . . . but you know them as well as we do.

Dusty problems

ALTHOUGH dust is a nuisance it has its uses. For instance, it has important effects on the weather. Dust particles form nuclei for condensation of water vapour when it is cooled to saturation point. Without dust the temperature of the water vapour would have to be far lower for condensation to take place and when it did the action would be violent.

It is fortunately realised nowadays that one of the greatest dangers of dust in enclosed buildings is in its explosive potential. Explosions can occur in any combustible dust or indeed any material that will burn or oxidise. When there is a critical air-dust mixture for rapid combustion it is said to be within the explosive range. This range includes air dust compositions from the lower to the upper limit. Below the lower limit flame propagation will not take place and above the upper limit there may be burning, but an explosion is not likely to occur in apparatus or enclosed spaces unless air is admitted.

The drier and finer the dust the greater its flammability. The spectre of a potential explosion must surely haunt the mind of any manufacturer who does not lay sufficient stress on effective dust control.

Continuous Fermentation in Industry: Its Evolution and Advances

By G. D. Wilkin*

In this article the author describes the evolution and advances made both in the design and process fields. Most of these advances have resulted from attempts to eliminate the disadvantages of batch systems, and although normal continuous fermentation methods are not recent developments modern products have necessarily involved reappraisal of techniques.

PRIOR to the work of Monod[1] and Novick and Szilard[2] which was published in 1950, the use of continuous fermentation techniques had been based largely on empirical methods. Since 1950 a considerable advance has been made in the understanding of the theory of simple open homogeneous continuous culture systems. It should be stressed in this context that this theoretical approach covers virtually only the growth of single cells in a single-stage reactor.

Predicting reactions

Using this theory the concentration of cells in a steady state can be predicted for experimental values of dilution rate and concentration of substrate if the growth constants of the organism are known. Herbert[3] has carried this basis of theory a stage further in classifying and attempting to define mathematically the predictable reactions occurring in more complex fermenter systems. These include single-stage continuous culture with cell feed-back, pipe flow fermenters, multi-stage stirred fermenters, a single chain of fermenters and two-stage processes with multiple substrate additions.

The predictable reactions which are defined in this way are concentration of limiting substrate, cell concentration and rate of wash-out of organisms. It should be noted that too little is known of most biochemical reactions of bacteria or fungi to attempt to predict from a theoretical mathematical basis the behaviour of similar systems when they are set to make a given product or to convert a given substrate. This therefore leaves rather an interesting situation at the present time in that it is possible to predict what will happen in terms of cell density and substrate concentration in the type of fermentation which can fairly readily be carried out by continuous techniques. At the present time, however, it is not possible to predict, in the absence of sufficient experimental evidence, what will occur in fermentations in which only limited advances have been made using the continuous fermentation approach.

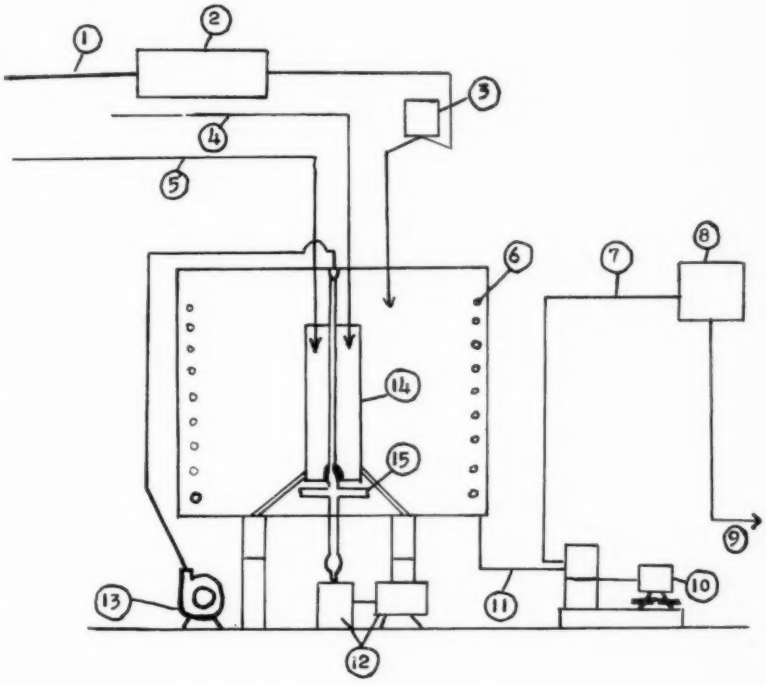


Fig. 1. The Waldhof fermenter system.

1. Neutralised liquor. 2. Cooler. 3. Wort sieve. 4. Ammonia. 5. Salts. 6. Cooling coils. 7. De-aerated liquor. 8. Tank. 9. Centrifuges and driers. 10. Centrifuge for de-aerating. 11. Fermented liquor. 12. Drive for aerating mechanism. 13. Blower. 14. Draught tube. 15. Aerating wheel.

It therefore appears reasonable at this stage to review generally the processes which have been used successfully for industrial production and then to try to assess the possibilities in terms of materials more recently produced by batch fermentation methods such as antibiotics, enzymes and steroidal substances. Rather bitter statements have been made by Malek[4] in which criticism is directed against the level of knowledge of fermentation workers generally and particularly in terms of their inflexible and conservative way of thinking. This has supposedly led them to imagine that it would be impossible to ferment in any other than the traditional way, *i.e.* by batch processes. If these statements are indeed true of the past then certainly the "wind of change" is

* Boots Pure Drug Co. Ltd.

blowing across the fermentation industry generally and has in fact been blowing since the end of the last Great War.

Evolution of fermentation processes

Since the war it is true that with the commercial production of antibiotics it became more necessary to have a more thorough technology and a better understanding of the biochemistry of fermentation processes. However it should be remembered that this fermentation technology was not suddenly acquired overnight, but was based on years of endeavour in producing cells or simpler fermentation products. Thus the evolution of fermentation processes, in which continuous fermentation must take its place in a logical line of development, has centred around attempts to eliminate the disadvantages of batch systems and most of this has involved continuous fermentation processes in some form or another. In this evolution of practical fermentation processes, as in any natural evolutionary line, there are side lines, new developments and on occasions even throwbacks to more primitive types. However, as in natural evolution, it is not always the most elaborate structure which fares best in a particular environment. In the industrial environment where the ruthless trimming of costs is inevitable in a competitive market a different form of equipment may of necessity arise than might be encountered in the cloistered calm of an academic establishment where the chill breeze of economics would not wither some newly acquired elaboration.

Conventional methods

Normal conventional methods of continuous fermentation, which present-day theory covers, are most certainly not recent developments. Such systems—on an empirical basis—were used to produce pressed yeast as early as 1915.[5]

In this case a single vessel was used which was fed with a nutrient sugar solution whilst an equal volume of wort was withdrawn and centrifuged (single-stage culture). Two fermenters were also used in which the first reactor was fed continuously and excess liquor was transferred to a second reactor where the yeast utilised the remaining nutrient (multi-stage fermenters). In the production of alcohol by yeast continuous methods have been used for at least fifty years. The oldest methods ignored completely sterility and similar difficulties which pose such great problems in the more refined techniques used at the present day. Thus fresh seed was prepared only as necessary either to begin the process or when the contamination level became so high as to suggest that this required diluting with fresh yeast cells. One established process—the Champanois process—utilised the direct overflow along a series of vessels (simple chain of fermenters). A modification of this used in large beet sugar and molasses alcohol plants had as its basis a large fermenter continuously fed with nutrient sugar solution. The overflow ran into smaller vessels which were discharged a short time after filling.

The Waldhof fermenter

As the technology of continuous fermentation using these simple processes became better known the processes became more efficient. Probably the end of this line of evolution is represented by the well-known Waldhof fermenter (Fig. 1), which ran on a continuous basis so effectively that, in Germany in 1945, fermenters of this type were producing 15,000,000 kg. of food yeast per annum.

Various types of tube fermenter also came to be used, from simple spiral pipes to fermenters like boilers attempting to use a counter-current principle, or where the culture was passed through various partly occluded compartments during the continuous process.

Virtually all these types of reactor have been dealt with by Herbert in his classification of continuous fermentation methods.

Modern products

In dealing, however, with modern products such as antibiotics, enzymes and organic acids, many of which are formed by filamentous organisms, a number of strictures need to be applied. Certain basic provisions must be made before any critical fermentation, whether batchwise or continuous, can be carried out successfully and economically. Medium in sufficient quantity must be provided for the process at a suitable cost; in a continuous process, because of its theoretically higher throughput of liquor, the rate of medium supply is of relatively greater importance than in batchwise processing. When suitable provision has been made for medium supply it is then necessary to sterilise this in most processes. This can be done either continuously or in a batchwise manner; some batch fermentations already have continuous sterilisation applied. Once sterility has been attained, normally of a complex medium, with the minimum destruction of essential nutrients, it is normally necessary in modern processes to maintain sterility throughout the course of the fermentation. In some particular types such as in the penicillin fermentation this is vital and failure to ensure complete sterility is catastrophic.

Batchwise processes running for periods up to seven days might be able to cope with a level of contaminating organisms. In fungal fermentations using a continuous processing technique, bacterial or other fast growing contaminants have time to develop, particularly if the growth phase is carried out separately from the production phase, and this is doubly dangerous if the contaminant is capable of producing a substance such as penicillinase which rapidly destroys the product in any reactor stages. Mechanical considerations must also play a large part. Thus in a stirred batch fermentation although the agitators may be running for five to seven days there are arranged intervals between fermentation for maintenance. In a continuous fermentation a stirrer breakdown for a length of time can seriously hold up the profitable throughput of the fermentation. The onset of a bacteriophage or actinophage attack in a continuous system is also a very real hazard which requires consideration. Inability to deal with this type of attack is again catastrophic.

Instrumentation

When a batch process is used all cycles of growth and production occur in the same vessel. One undoubted benefit of multi-stage continuous processes lies in the ability to separate the different fermentation phases. However, because of this, different types of fluid including sterile medium, thickly grown liquors and chemical substances such as precursors and antifoams require to be metered accurately.

Maxon[6] suggests that continuous fermentation is more readily adaptable to instrumentation. Modern techniques suggest that full instrumentation is a necessity for the

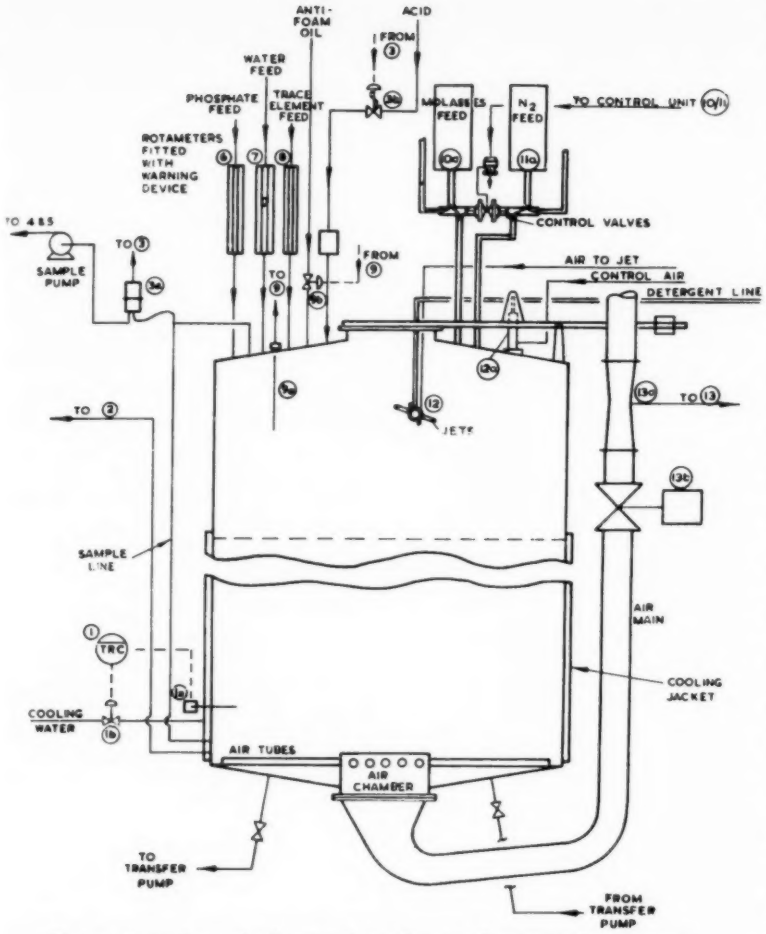


Fig. 2. A modern single vessel continuous fermentation system.

1 Temperature controller and recorder.* 1a Resistance thermometer. 1b Control valve. 2 Fermenter level.* 3 *p*H recorder and controller.* 3a *p*H electrode system. 3b Control valve. 4 Yeast concentration recorder.* 5 Formol recorder controller.* 6 Phosphate feed rotameter. 7 Water feed rotameter. 8 Trace element feed rotameter. 9 Foam controller.* 9a Foam detector. 9b Control valve. 10/11 Dosage control unit. 10a Molasses feed. 11a Nitrogen feed. 12 Rotor jet. 12a Power unit. 13 Air Controller recorder.* 13a Venturi. 13b Power operated air control valve.

*Indicates panel mounted instruments.

success of continuous processes as, unlike batch processes, they do not allow the human element in plant control to be so readily applied.

Culture degeneration

Another complication which has beset the minds of workers on continuous culture has been the bogey of culture degeneration. This was investigated by Novick and Szilard who used a "chemostat" in order to study the spontaneous mutation of bacteria. Newry[7] showed that *clostridium saccharo - aceto - butylicum*, which undergoes a well - defined degeneration on serial batchwise transfer, did in fact retain its culture characteristics in continuous fermentation, and degeneration only set in when batch transfers were carried out from the continuously produced liquor.

Another often recurring idea has been that fermentations which are producing a chemical substance such as streptomycin require to go through a specific cycle of reactions. This has led some investigators to suggest that in these processes therefore it would be impossible to carry out this cycle of reactions in continuous fermentation. Modern work, such as the production of streptomycin in a two-stage fermentation[8] and the similar production of penicillin in single stage[9] or in two-stage fermentation,[10] strongly refutes this suggestion.

Sterility

The other major hazard, that of sterility, has been shown to be surmountable by such workers as Herbert and Ellsworth, who have been able to run continuous fermentations successfully for periods in excess of 3,000 hours without contamination. While this was achieved in small-scale equipment, the only logical difficulty in translating this to the large-scale lies mainly in the question of expense. As is shown in the evolution of continuous processes, this question can only be resolved at the scale used and depends very largely on the amount of money which can be spent on any particular process. Thus for a continuous process, used in the production of a relatively expensive product such as vitamin B_{12}, the provision of suitable equipment would be economically possible despite the initial expense. In terms of a product which sells at a relatively low price, such as pressed yeast or citric acid, the economic basis would require more careful study before such expensive equipment was installed.

Production of yeast

Having seen the way in which continuous processes have evolved generally and the difficulties which may be encountered, it now remains to see how these are being applied in modern industrial technology. The simplest process, as has already been stated, is one in which cells are produced as a final product. Olsen and Sher have published details of what they believe to be the first plant for the commercial production of baker's yeast, without alcohol, by continuous fermentation.[11] Using this plant on a batch process 225 tons of pressed yeast per week were produced; when the plant was modified to run on continuous fermentation its capacity was increased to 300 tons per week. In this process the contamination hazard and control difficulties have been countered by improvements in plant design and control by the use of reliable instruments. The authors emphasise that even in this process the "steady state" of fermentation has not so far exceeded 80 hr. It must be borne in mind that their problem is not so much to produce yeast economically and in large quantities as to ensure a product of

the highest quality. In the actual fermentation technique used little advance has been made on earlier methods, sterility being one of the factors limiting the length of time for which the process can be run.

The fermenter used (Fig. 2) can be seen to be essentially similar to the Waldhof fermenter with the real advances made in instrumentation. This is considerably ahead of any such equipment previously described for this type of process. The application of this control equipment for sterilisation and specific gravity control of molasses feed, temperature control, flow control of water, phosphate and air, programmed transfer control, *p*H control, molasses and nitrogen dosage, foam control and recording of concentration are described by the authors. In addition to this there is a continuously recorded test carried out for the keeping quality of the yeast. This highly elaborated system of process control allows the use of a central panel where a system of warning lights informs the operator when the process is changing. The final and as yet uncompleted refinement of such a system rests on the use of the fermenters to give a fully continuous process of yeast production. This poses problems in terms of shutdown of plant and sterility controls which the authors consider to be unnecessary under the prevailing economic circumstances.

In the yeast field, but in this case where alcohol as beer is required as the main product instead of cells, advances have been reported by Hough.[12] In pilot scale equipment beer has been produced continuously of similar quality to that produced by conventional methods, but under steady state conditions allowing production of beer at three to twenty times the speed current in orthodox breweries. The figures quoted by the author do not take into account the " turn-round " times required for batchwise methods.

Vitamin B_{12} production

Riley *et al.*[13] report an interesting use of a two-stage process of continuous fermentation to produce vitamin B_{12} and an analogue. This process was also carried out on a small pilot scale to prove its practicability and demonstrated that the two-stage system was wasteful compared with the batch fermentation from which it was developed. The authors suggest that addition of a third fermenter in the reactor series might make the process economically sound.

The organism used in this fermentation was *Propionibacterium feudenreichii*, which grows well under anaerobic conditions and tolerates aerobiosis. The D.C.L. process in which this organism is used[14] is carried out by a batchwise method in two stages. These stages are:

(*a*) A stage in which factor B is formed, the formation of this being depressed under aerobic conditions.

(*b*) A stage in which factor B is converted to vitamin B_{12} by combination with a nucleotide containing 5 : 6 dimethyl benziminazole as its base. This reaction is completed under aerobic conditions.

A fermentation of this type is obviously ideally suited for a double-stage continuous reactor system. This was done by running the first reactor under anaerobic and the second reactor under aerobic conditions and by this means, with a retention time of 66·6 hr., a titre of 11·1μg./ml. of vitamin B_{12} was obtained in the second reactor. A further interesting feature of this work lies in the length of time for which it was possible to run the reactors. Thus in one experiment the fermentation was maintained for as long as 5,770 hr. The authors point out that in this process an increased output of vitamin B_{12} has been at the expense of increased nutrient requirement and of an increase in the volume of liquid to be dealt with per unit weight of product.

This finding appears to be fairly general in work in continuous fermentation where a chemical product is formed for extraction at the end of the process. In the penicillin process a decreased titre per unit volume of brew results from continuous operation as compared with the batch process. Under these circumstances it is necessary to weigh the increase in productivity against such factors as increased solvent requirements. A product such as vitamin B_{12} or streptomycin which can be absorbed on to alumina or resin columns does not offer such difficulties except in terms of medium cost.

Production of acids

The advances made in continuous fermentation processes are not so readily stated in considering the production of organic compounds such as citric, glutamic and lactic acids. The citric acid fermentation has only fairly recently moved from the surface process, which was semi-continuous, to the submerged fermentation technique. Feasibly therefore there still remain many problems to be overcome before the operators of this process will find themselves in a position to consider the continuous fermentation approach. As such compounds as citric acid are relatively cheap when compared with vitamins and antibiotics, the prime economic consideration when changing from surface to submerged culture methods would be the need for large batchwise vessels in order to make the product as cheaply as possible. Having acquired large batchwise vessels for such a process it makes it very difficult to think in terms of new and possibly smaller more specialised plant to allow a continuous process to be successfully carried out.

Enzyme production

In the past few years there has been a marked increase in interest in the commercial production of enzymes by submerged fermentation. Thus commercial proteases are now available from fungal and bacterial sources. These are extensively used for dehairing hides, tenderising meat, producing protein hydrolysates and removing turbidity from beer. Amylases are becoming more widely used in the baking industry. Bacterial carbohydrases are used in the retting of flax. In addition to these pectinases and cellulases are coming increasingly to the fore in commercial use. Despite these obvious uses for enzyme preparations there is little knowledge of the use of continuous processes to produce such materials. Some amylase is being produced commercially by submerged fermentation, but it is very doubtful whether any commercial process of continuous fermentation is being used. It may well be that the same reason may be advanced for this as for citric acid, and as enzyme technology becomes more advanced the continuous approach will come more to the fore.

Treatment of waste materials

In addition to the use of continuous fermentation for the production of antibiotics and similar compounds it is also being increasingly used in the katabolic treatment of various waste materials.

The problem of disposal of carbonysation effluents is being well

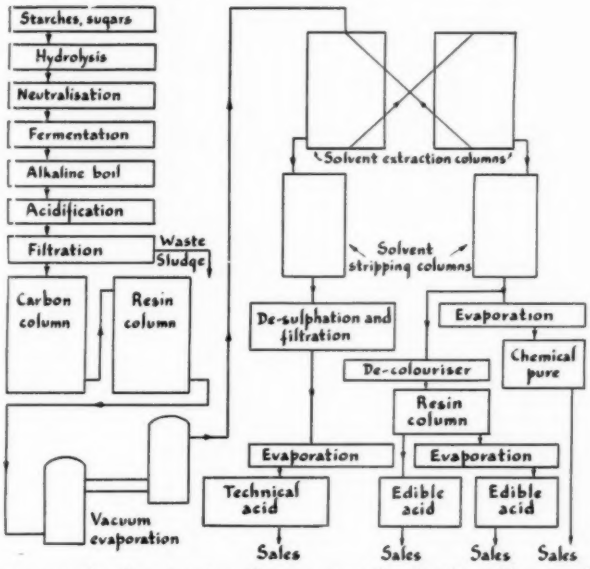
(*Continued on page* 356)

Prospects for Lactic Acid

By M. H. M. Arnold,* B.A., B.Sc., LL.B., F.R.I.C., A.M.I.Chem.E., and C. G. Childs,* M.Sc., A.R.I.C.

The recent production of pure lactic acid by solvent extraction has made available at a reasonable price a grade that should find many uses in chemical synthesis. In addition lactic acid has many properties of nutritional and dietary interest.

ALTHOUGH lactic acid has been commercially available for over 50 years, and has been known for twice as long again, it has never attained that special position in the chemical industry which its bifunctional structure would seem to justify. This can be attributed to the fact that it has never been available at all pure at a reasonable price, and that the usual impurities—sugars, amino-acids, inorganic salts and colouring matters—are particularly objectionable in chemical synthesis. The recent industrial development of purification by solvent extraction† has, for the first time, made a chemically acceptable acid available at a reasonable price, so that considerable increases in its use can be expected. Lactic acid is the only readily available α-hydroxy acid except glycollic acid, and should therefore have a definite rôle to fill in chemical synthesis. Up to the present time, however, the compound has been neglected in this field.



Flow diagram of solvent extraction process for lactic acid manufactured by continuous fermentation.

Food uses

Lactic acid possesses other specific properties which make it of great interest in a variety of fields and which are not related to its potential in chemical synthesis. It already finds a wide use as an acidulant for the flavouring of soft drinks,[1] beer, boiled sweets, jams and the like. Here it is in competition with citric and tartaric acids, and the choice is determined largely by somewhat minor differences in flavour. Acid taste depends not so much upon *p*H as upon total titratable acidity, and the way in which the acid taste expresses itself on the tongue is connected with the shape of the neutralisation curve. This is not important in many flavouring applications, but lactic acid is of particular value in the flavouring of boiled sweets[2] because it is possible to raise the *p*H by buffering with sodium lactate, thus reducing the amount of (undesirable) inversion of sucrose, without sacrificing any of the acid flavour or producing a salty taste. At the same time the solubility of the sodium salt prevents any cloudiness in finished high-boiled sweets.

No metal lactates are highly insoluble and some are very soluble; this fact can almost certainly be ascribed to the formation of weakly chelated complexes. These complexes are of typically low conductivity, but they do not approach the stability of the conventional chelated complexes, and thus give up their metal quite readily. Heavy metal lactates thus afford solutions of high and available metal content. It is believed that complexing of this kind is necessary for the uptake of metals in human and animal nutrition, and the beneficial effects of lactate in nutrition, which will be dealt with more fully below, may be in part ascribed to the mobilisation of trace elements in the diet as complex lactates.

Effect on proteins

Lactic acid exerts a characteristic plasticising action on proteins, probably owing to the way in which it can increase their water uptake by polarity adjustment. The effect is not fully understood, but results in an increased flexibility and extensibility of the protein—an increase in long-range elasticity in fact. The phenomenon is of practical value in three unrelated fields. In tanning, where the use of lactic acid is traditional, there appears to be a special effect on the swelling of the collagen. In baking, the effect of lactic acid on the gluten shows itself in an improvement of the quality of bread made from poor flour, and especially in rye bread.[3] Even more striking is the recently discovered effect of lactate on the albumen in egg white. As much as one-quarter of the albumen content of meringue mixes and similar formulations may be replaced by the much cheaper calcium lactate without any deterioration in the quality of the foam produced.[4] One may speculate upon the value of lactate treatment of hair, fur and wool when the protein keratin has been converted into a tractable form by the action of thioglycollic and thiolactic acids; the analogy between these and lactic acid is well worth noting.

*Bowmans Chemicals Ltd.

†See MANUFACTURING CHEMIST, 1959, **30**, (6), 249.

Lactic acid is a compound of primary importance in animal (but not usually in vegetable) physiology. Its status may be summed up by saying that it is the normal end product of anaerobic carbohydrate metabolism; the commercial production of lactic acid by anaerobic fermentation of sugars and the metabolism of blood glucose to lactic acid in working muscle are examples of this. It follows that lactic acid and lactates are entirely harmless in the diet, since they are actually formed in the body as part of its normal metabolic processes. The physiological status of the two optical isomers is not entirely clear; metabolism of glucose in the tissues yields L(+) lactic acid, but many microbiological processes give the racemic mixture, and there is in any case reason to believe that lactic acid is readily racemised in some biological systems. While there is no doubt that both isomers are metabolised in the body, there is some reason to believe that *anabolic* (tissue building) processes require L(+) lactic acid. It is, of course, extremely unlikely that nutritional conditions could ever arise which would make ingested lactic acid of anabolic significance.

An important consequence of the status of lactic acid as a final stage of anaerobic catabolism of carbohydrate is its ubiquitous occurrence in anaerobic biological systems. Thus it occurs, not only in the intestinal tract of all animals, but during fermentation processes as diverse as those occurring in the production of silage, pickles, sauerkraut, wine, cocoa, tobacco, cheese, and bread. In such systems it appears to play an important and sometimes decisive rôle in controlling the microfloral population, partly by reducing *p*H, and partly by a specific inhibitory effect on the multiplication of proteolytic organisms (or perhaps more precisely of organisms capable of decarboxylating protein breakdown products). In fact, it suppresses undesirable fermentations and hence the development of undesirable flavours and textures in the fermentation processes mentioned. Since under natural conditions an appreciable period of time may be necessary before the anaerobic conditions necessary for formation of lactic acid can be developed, addition of lactic acid or lactate can minimise the risk of undesirable flavours developing during this preliminary period. The general validity of this picture has only recently been realised, and thus the utilisation of lactic acid in many cases is still in an early stage.

In the animal intestine conditions are always substantially anaerobic. The difficulty here is to ensure that the diet contains enough lactic-acid-forming bacteria to maintain a high population and hence the required controlling concentration of lactate. The use of cooked and cleaned food by man and even by domestic animals does mean that the intake of suitable bacteria is markedly reduced. Hence, no doubt, the high reputation enjoyed by such materials as sour milk and sauerkraut in certain dietary régimes. It is not, of course, self-evident why the presence of lactate and the control of microfloral population should be of significance in the gut. The possible value of lactate in mobilising trace elements has already been mentioned. More important is the fact that undue proliferation of proteolytic organisms leads not only to waste of protein through its conversion to compounds of lower biological value, but also to the production of toxic compounds in the gut. To put it crudely, in the absence of the control exercised by lactate proteins in the gut tend to putrefy instead of being digested. It is interesting that even *fresh* milk is beneficial in this respect, since lactose is less readily absorbed from the stomach than other common sugars and thus, although not a more suitable substrate than other sugars, passes into the intestine in concentrations high enough to favour multiplication of the existing population of lactic acid bacteria. It is suggested that some of the beneficial effects of milk and milk products, more particularly of skimmed milk powder in animal feeding stuffs, can be attributed to this effect of lactose, rather than exclusively to the vitamin and protein content.

Dietary applications

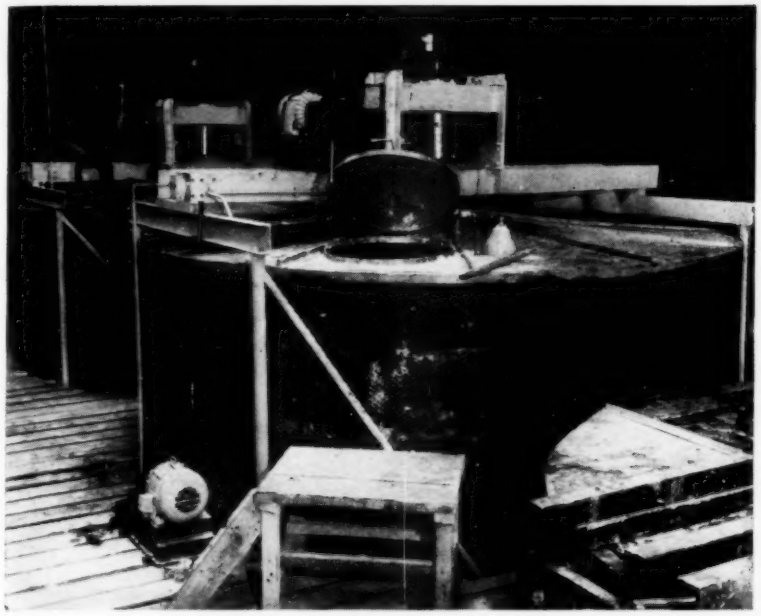
In cases where protein availability limits the production of body protein it would be expected, on the basis of the foregoing argument, that addition of lactate to the diet would result in improved growth. Since the above ideas have only recently been formulated as a general hypothesis, full experimental investigations have not yet been made. Addition of lactate to a good quality diet fed *ad lib.* to growing chicks gives, as would be expected, only a slight increase in the efficiency of food conversion. On the other hand, in the special case of egg production, where large amounts of protein are developed rapidly by the body and where this development is known to be critically responsive to changes in diet, it is in fact found that addition of small amounts of calcium lactate to the diet can give a substantial increase in egg production efficiency, displayed, depending on the effect of other factors, either as an increase in egg production or a decrease in food consumption, or both.[5] It is tempting to suggest that lactate may become important in human nutrition in areas of chronic protein deficiency.

An unrelated dietary application of lactates is in the prevention and cure of "slow fever" in cows and "twin-lamb disease" in sheep.[6] These are metabolic disorders arising from aberrations, under conditions of poor diet and physiological stress, in the complex digestive system of the ruminant. Economically they are of great importance. Since they depend upon an imbalance in the propionate acetate ratio in the blood, they are in principle curable by administration of a three-carbon compound such as propionate, lactate, or glycerol. Calcium di-sodium lactate is the compound of choice, and recent developments have made this compound available at a price low enough for it to be incorporated in feeding stuffs as a preventive as well as a curative agent.

Chemical formulations

Lactic acid has been used in several types of chemical formulation where its particular combination of chemical properties has given it special applicability. Thus a fairly strong, non-volatile, non-crystallising acid which forms no sparingly soluble salts is called for as an ingredient of soldering fluxes and lithographic etching fluids. More recently lactic acid has emerged as the acid of choice for the acidification of dye baths in the application of the new types of printing dyestuffs, solubilised by the incorporation of isothiuronium groups in the molecule, which react on the fibre to give dyeings with a very high degree of fastness to washing.[7]

The sodium, potassium and ammonium salts of lactic acid are extremely soluble in water and are commercially available as aqueous solutions of about 70-80% strength by weight. Strong sodium lactate solutions have a very considerable humectant property, being somewhat superior to glycerine solutions in this respect, on a weight for weight



Lactic acid fermentation vessels.

basis, and having the further advantage that the *p*H of solutions can be adjusted by the addition of lactic acid. The availability of a humectant with buffering properties at *p*H 5 should be of value in the formulation of cosmetics and lotions for readjustment of skin *p*H after surgical scrubbing or immersion in detergent solutions.

Chemical synthesis

The application of lactic acid in synthesis can be summed up by saying that it is an α-hydroxy acid. Because of the practical unavailability of such acids in the past the record of existing synthetic applications is meagre, while, on the other hand, numerous proposals are to be found in the patent literature and innumerable paper reactions may be set down as a purely intellectual exercise; the position has recently been reviewed by Machell.[8] More constructively one could point to the value of the esters, where the free hydroxyl group contributes a characteristic polarity pattern and permits of further synthesis. The ethyl and butyl esters are in regular large-scale production, and lactyl derivatives of long-chain glycerides have been used as edible emulsifying agents. Esters in which the hydroxyl group is esterified and the carboxyl group left free do not seem to have been exploited although they are readily accessible. It follows, of course, that lactic acid will esterify with itself, and lactyllactic acid does in fact occur to the extent of some 20% in the commercial 80% lactic acid where, however, its presence is unobjectionable owing to its comparatively ready hydrolysis. A cyclic di-ester, lactide, is well known and has attracted some attention as a raw material for synthesis. The process of self-esterification can continue to an indefinite extent, giving the so-called poly-lactic acids which range from viscous liquids to vitreous solids. They tend to be characterised by fairly ready hydrolysis. On the other hand, when a single optical isomer is used as starting material, poly-lactic acids of more interesting properties are formed;[9] these are capable of being spun to give fibres of improved tensile strength combined with increased resistance to hydrolysis. This difference is easily understood when it is realised that polyesters from a single optical isomer are, in fact, isotactic condensates and would be expected to exhibit those differences in chemical and mechanical properties which are known to be exhibited by isotactic polymers generally. Such isotactic condensates are of more than academic interest since the production of optically pure lactic acid is a commercial possibility.

Lactic acid will likewise take part in the formation of mixed polycondensates, such as alkyd resins. Here it will act as an additive of zero functionality, participating in an esterification to leave a reactive terminal group of the same kind as that with which it originally reacted. The effect is thus of overcoming steric difficulties which can hinder effective condensation. The use of lactic acid to increase the degree of reaction in this manner is in its infancy. A probably more important application is in overcoming the major disadvantage of oil-modified alkyds in paints, their often dangerously low adhesion and water permeability, which are conducive to blistering and flaking when the paint is applied under bad conditions. Since the incorporation of lactic acid effectively does no more than add ester linkages to the polycondensate, it can be used to adjust the hydrophilic/hydrophobic balance. Besides the application in paint alkyds, a similar effect may well be of interest in alkyds used in glass-fibre laminates, where proper wetting of the fibres can sometimes be a problem.

In the synthesis of phenolic and amine resins lactic acid is widely used as a catalyst, or, more generally, as a *p*H controller. The requirement here is for an acid which is itself compatible and whose salts do not readily crystallise and cause cloudiness.

Several attempts have been made to use lactic acid as a raw material for acrylic acid, thus, opening up a new route from fermentation chemicals to acrylic polymers. There is no difficulty about carrying out this transition by the route involving esterification of the hydroxyl group with acetic anhydride, followed by pyrolysis to give acetic acid and acrylic acid. Unfortunately, this involves the degradation of acetic anhydride to acetic acid, and the cost of the re-conversion is such as to make the route commercially unattractive. Claims have been made for the direct conversion, but it would appear that yields are none too good.[10] A more attractive line of approach might be the use of an esterifying agent which is more readily recovered than acetic anhydride. Phthalic anhydride is a possibility (although data do not exist for confirming thermodynamic feasibility) bearing in mind its use for the analogous process of dehydrating castor oil. In fact this dehydration is usually carried out *in situ* in the production of dehydrated

(*Continued on next page*)

Semi-Mechanical Blending of Perfumes

LAUTIER FILS' NEW INSTALLATION

THE PERFUMERY department of Lautier Fils Ltd., of Chiswick, London, has been transferred to a new building adjoining the main premises in Power Road. Mr. Ivan Gerard, managing director, organised a reception to inaugurate the new building which was attended by the French Commercial Counsellor in London.

Mr. Gerard spoke of the marrying of British management, skill and labour with a basic knowledge which is typically French—the art of perfume compounding and blending.

The building has two floors. On the top the perfumes and compounds are stored in stainless steel vessels. On this floor too is the perfume laboratory where blends are created by the perfumer with hundreds of notes at his disposal.

The bulk blending is done on the ground floor. A system of 30 glass pipelines is connected to the vessels on the first floor. Each pipeline ends in a glass valve which gives accurate control of the gravity flow. Underneath the pipelines is a trolley on rails fitted with platform scales. Proportions of the blend to be compounded are marked by weight on the scale face. The operative moves the mixing vessel from one valve to another, admitting the required proportions of geraniol, lemongrass, terpineol, etc., and checking them with the scale pointer.

The glass pipeline system for blending perfumes on the ground floor of the new building.

The glass pipelines provide an elegant and simple system of bulk blending with the minimum of exertion. Supplies in the upper floor are checked by float level indicators fitted to each vessel.

Of course, not every compound can be accommodated in the pipeline system. However, it is able to take the 30 main compounds and smaller quantities to make up a blend are added by hand.

The main premises next door have been extended to house a range of stills and ample room has been left for further installations.

The new distillation hall in the extension of the main premises. A third line of stills will be installed in the centre.

LACTIC ACID *(Continued from previous page)*

castor oil alkyds, and a similar line of thought leads to the concept of incorporating lactic acid in a more complex compound which could then be dehydrated to give double bonds which might not otherwise survive the synthesis.

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Filtration: RECENT ADVANCES

By P. J. King,* B.SC., PH.D.

In this review of filtration developments of importance to the fine chemicals industry, Dr. King surveys the pretreatment of slurries, filter cake removal, porosity and filter media and concludes with a section on improved equipment.

THE last review of filtration appeared in this journal in 1957.[1] In that article Osgood dealt with the then current technical position of filtration in the fine chemicals industry. Much work has been published in the literature since 1957 and it would be impossible to attempt a complete and comprehensive review of all this work. The present article is an attempt to select the apparently more important and interesting developments published during the last few years in the more readily available literature. Particular emphasis has been laid on articles of interest to the fine chemicals industry. A more comprehensive literature survey up to the end of 1958 has been published by Grace.[2]

In order to restrict the field the subjects of gas cleaning, aerosol filtering, etc., have only received passing mention, and most attention has been focused on the problem of liquid-solid separation by means of porous media, together with the attendant problems of cake washing and cake dewatering, etc.

Pretreatment of the slurry

Much of the published work on filtration has neglected the importance of the pretreatment of the slurry. However, in 1955 Pratt[3] discussed the savings which could be made by suitable pretreatment and it was suggested that in any problem the following points should be considered before the actual filtration was undertaken:

(1) Settling, decanting and thickening.
(2) Classification and separation devices.
(3) Temperature adjustment and viscosity reduction.
(4) Adjustment of *p*H.
(5) Flocculation, coagulation and chemical treatment.
(6) Use of filter aids.

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The filter cake

The classical approach to rate data for filtration problems was based on developments of the Carman-Kozeny equation (for flow in porous media) and references to this will be found in almost any unit operations textbook; particularly useful summaries are due to Carman,[4] Green and Lane[5] and Weissberger.[6]

Basically, theory has normally been developed to cover two cases, filtration at constant rate and filtration at constant pressure, and it has generally been assumed that filtration, after the initial build-up of pressure, can be considered to take place at constant pressure.

The methods of determination for rate data may be classified into three groups:

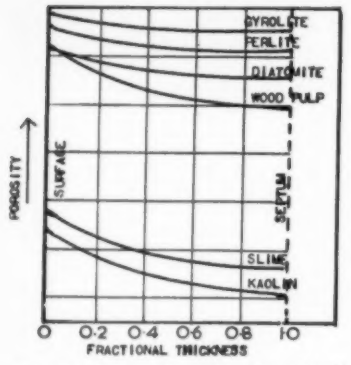
(1) Basic particle and cake properties.
(2) Permeability tests.
(3) Small-scale filtration tests.

The methods of group 1 are well developed for flow in porous beds but are difficult to apply directly to filtration problems. However, the methods of the other groups have been much used and data for constant pressure operation determined by both methods were compared by Kottwitz and Boylan[7] in 1958. It was shown that both methods gave comparable results and filtration test data could be predicted from permeability measurements.

Much of the published work has concerned group 3, that is, filtration on a small experimental scale, and then the extrapolation of these results to full-size equipment. Purchas[8] in 1957 described the basic test apparatus required for the sizing of rotary vacuum filters. This consisted of a filter element in the form of a disc or leaf which could be covered with filter cloth. (The leaf illustrated had an area of 0·1 sq. ft.) Vacuum was conveniently obtained by means of an electric vacuum pump (the capacity of a water pump was not sufficient for an air flow of 3-4 standard cu. ft./min.) and the slurry was conveniently kept in a bucket; gentle handstirring was recommended. With such simple apparatus it was found to be easy to simulate in the laboratory the filtering cycle of a rotary vacuum filter.

NOMENCLATURE

B	weight of dry cake solids per unit area per cycle.
E	wash efficiency %, *i.e.* 100-X at $n = 1{\cdot}0$.
f	permanent residual moisture as a fraction of voidage.
F_a	a factor defined by equation 7.
g	acceleration due to gravity.
G	form filter rate, volume per unit area per unit cake formation time.
h_L	height of liquid level above the bottom of the bed.
H	depth of bed.
k'	a constant.
%M	weight % moisture in filter bed.
$\%M_r$	weight % residual moisture in filter cake.
n	wash ratio (V_W/V_1).
[P]	a dimensionless ratio relating compressibility with pressure.
R	modified specific resistance.
R*	resistance of porous media.
S_o	surface area per unit volume of bed.
S	total volume of liquid above base of bed, divided by the pore volume.
t	time.
t_o	time at which bed was saturated (*i.e.* S = 1).
v	volume of filtrate per unit area for filtration.
V_1	volume of liquor in cake before washing.
V_W	volume of wash liquor.
w	weight of dry cake solids, unit volume of filtrate.
W	weight fraction of solute remaining in cake after washing (basis W = 1 before washing).
X	% solute remaining in cake after washing (basis X = 100 before washing).
y	variable depending on particle size.
subscript c	refers to cake.
b	refers to filter base.
ΔP	pressure drop in cake.
ΔP_f	pressure drop during formation.
ΔP_w	pressure drop during dewatering.
ϵ	void fraction.
θd	cake dewatering time.
θf	cake formation time.
μ	viscosity.
ρ	density.
ϕ	some function.



(Source F. B. Hutto, *Chem. Eng. Prog.*, 1957, 53, 328-32.)

Fig. 1. The distribution of porosity in filter cakes.

In 1958 Neu, Kobata and Lippla[9] described a similar type of test leaf fitted with a controllable "shave off" which enabled the relative values of filter aids to be assessed in the laboratory and accurate scale up to full size equipment to be made. Such a leaf is well suited to the study of the effect on filtration rate of depth of knife cut, type of filter, speed of drum rotation and other variables.

A useful discussion and analysis of rotary precoat filter operation was made in 1958 by Bell and Hutto.[10,11] The experimental work described was carried out on a rotary drum filter with a 2 in. layer of filter aid built up on the cloth. The doctor blade was advanced by a controlled amount per revolution (usually a few thousandths of an inch), thus continually exposing a new surface of permeable filter-aid. It was shown that, in general, the rate efficiency tended to be higher with deeper cuts, and that if "surface blinding" was heavy, a deep cut (more rapid knife advance rate) was needed. On the other hand, if there was rate loss due to deep penetration of the aid, it was recommended that a more retentive filter aid should be used.

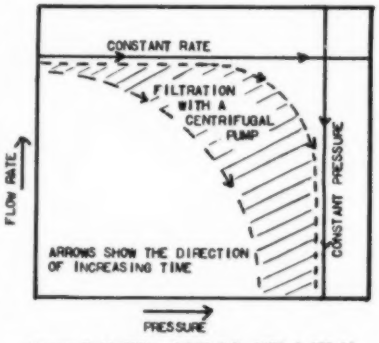
Porosity

The distribution of porosity in filter cakes was studied by Hutto in 1957.[12] A banded cake was built up inside a transparent filter and the position of the bands was photographically recorded. It was concluded that the porosity of the cake decreased fairly rapidly near the liquor face and continued to decrease almost linearly down to a minimum porosity near the septum (see Fig. 1).

Also in 1957, Heertjes and Nijman[13] gave experimental proof that cakes formed during filtration were not homogeneous, and the effect of this lack of homogeneity on the consolidation of the cake was discussed. It was shown that consolidation could actually increase permeability, since the consolidation of certain areas caused a depletion of material in other areas, and hence quite large channels within the cake could be opened up. In 1959 Bakker, Heertjes and Hibou[14] followed up this work and studied the influence of initial filtration velocity and of vibration on the resistance of a filter cake made up of polystyrene spheres of known diameter. Three different and well-defined filter media were used as supports. The influence of the initial filtration rate was expressed mathematically; there was an increase of cake resistance from zero at infinite initial velocity, to a maximum value at zero initial velocity. The parameters in this study depended on particle size and on the system. The influence of vibration was studied qualitatively and in general it was found that the mean resistance increased with vibration and with increasing amplitude and frequency; this influence was found to be greater in cakes with a high resistance to flow.

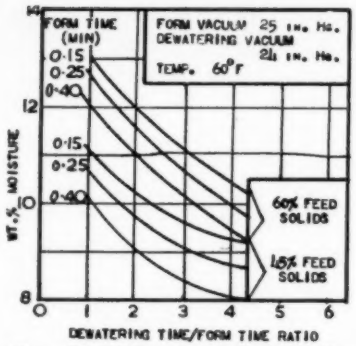
Variable pressure filtration

As mentioned earlier, most literature has considered constant pressure, or to a lesser extent constant rate, filtration. However, in 1958 Tiller[15] pointed out that in practice most industrial applications involve the use of centrifugal pumps, and hence filters are operated under variable pressure–variable rate conditions (with rotary vacuum filters the cake is subject to a series of pressure surges). Thus Tiller concluded that much of the published literature



(Source F. M. Tiller, *A.I.Ch.E.J.*, 1958, 4, 170-4.)

Fig. 2. The relation between constant pressure and constant rate filtration and operation with a centrifugal pump.



(Source P. A. Nelson and D. A. Dahlstrom, *Chem. Eng. Prog.*, 1957, 53, 320-7.)

Fig. 3. Cake moisture content for taconite iron ore concentrates.

was of questionable value. The relation of the three types of flow régime is shown in Fig. 2; note the position of the centrifugal pump curve depends on pump characteristics. Equations were developed for the variable pressure–variable rate case, and methods were discussed for determining the average filter resistance as a function of compressive pressure. Methods were proposed for the determination of point filter resistance from data for average resistance.

Rate equations

Filtration equations, even when essentially simple, usually appear complicated because of the number and variety of the symbols involved. In 1957 Hassett[16] attempted to rationalise the theoretical treatment and to present data in a more convenient form.

The resulting equation took the form for the cake:

$$R_c^* = \mu R_c [P]_c v \quad . \quad . \quad . \quad (1)$$

where R_c is the modified specific resistance, and is a cake constant for a particular slurry, and $[P]_c$ is a dimensionless relationship between the resistance under the new pressure conditions and those used for the determination of R_c.

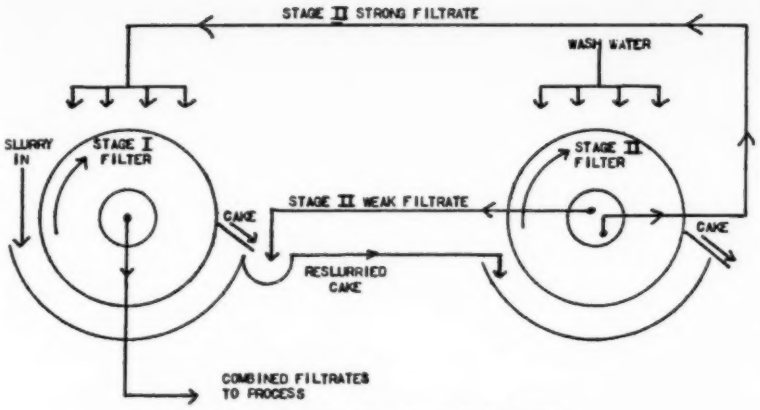
For the septum, or filter base, the corresponding equation was

$$R_b^* = \mu R_b [P]_b \quad . \quad . \quad . \quad (2)$$

(Note: This contains no "thickness" term.) R_b is the resistance of unit area of filter medium to flow of fluid of unit viscosity when under an average pressure of unity.

The filtration flow rate was obtained from the expression

$$\frac{dv}{dt} = \frac{\Delta P}{\mu R_c [P]_c v + \mu R_b [P]_b} \quad . \quad . \quad (3)$$



(Source D. B. Purchas, *Brit. Chem. Eng.*, 1957, **2**, 307-15.)

Fig. 4. Counter current washing with rotary vacuum filters.

When integrated for constant pressure equation (3) became

$$\tfrac{1}{2}R_c[P]_c(V_2^2-V_1^2)+R_b[P]_b(V_2-V_1) = (t_2-t_1)\frac{\Delta P}{\mu} \quad . \quad . \quad . \quad (4)$$

and a plot of $\frac{\Delta P}{\mu}\left(\frac{t_2-t_1}{V_2-V_1}\right)$ against (V_2-V_1) using linear co-ordinates gave a straight line with a slope of $\frac{1}{2}R_c[P]_c$, the intercept at $(V_2-V_1) = 0$ gave $R_b[P]_b$.

Dewatering rates

Nenniger and Storrow[17] in 1958 published the results of a study of the drainage of packed beds. The main interest was for hydro-extraction with a centrifuge, but for the gravity case they proposed an expression for the total volume of liquid above the base of a bed divided by the pore volume (S).

$$S = \frac{h_L}{H}(1-f)+f+\frac{2}{3}\frac{So}{\varepsilon}\sqrt{\frac{H\mu}{\rho.g}}\sqrt{\frac{(1-h_L H)^3}{(t-t_0)}} \quad . \quad . \quad (5)$$

Note: from the definition $S>1$ when $h_L>H$ and $S<1$ when $h_L<H$.

The complete integral for equation 5 was not determined, but two methods of solution were proposed, one being a graphical integration and the other a series solution. Illustrative examples were worked.

Moisture content

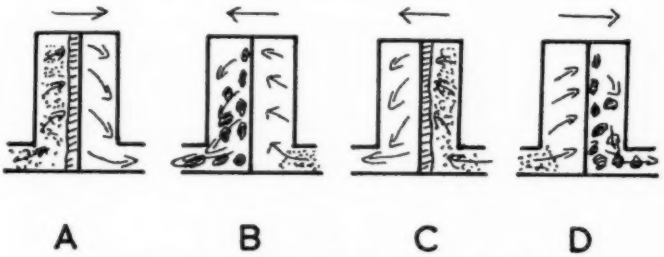
A correlation for the moisture content of rotary vacuum filter cakes was published by Nelson and Dahlstrom[18] in 1957. For incompressible cakes

$$\%M = \phi(Fa,\%Mr,y) \quad . \quad . \quad . \quad (6)$$

where

$$Fa = \frac{\theta d G}{B} \cdot \frac{\Delta P w}{\Delta P_f} = \frac{1}{w} \cdot \frac{\theta d}{\theta f} \cdot \frac{\Delta P w}{\Delta P_f} \quad . \quad . \quad (7)$$

The assumptions were (1) an incompressible cake, (2) negligible filter cloth resistance, (3) uniform and unchanging cake specific permeability. Although these assumptions are not in general justified, deviations do not apparently invalidate the derived equations. This relationship is expressed graphically in Fig. 3 as cake moisture as a function of dewatering time and form time for taconite iron ore concentrates.



(Source J. G. Brown, *Chem. Eng. Prog.*, 1956, **52**, 238-40.)

Fig. 5. Reversible filtration.

Washing rates

Choudhury and Dahlstrom[19] in 1957 considered the theory of filter cake washing on continuous equipment with the assumption that the mixing of the strong liquor and the wash liquor was controlling, and it was shown that

$$\log W = -k'\frac{Vw}{V}+\log\frac{1}{k'} \quad . \quad . \quad . \quad (8)$$

The ratio $\frac{Vw}{V_l}$ gave the number of displacements of the wash, and was termed the " wash ratio " n.

It was further shown that

$$\frac{X}{100} = \left(1-\frac{E}{100}\right)^n \quad . \quad . \quad . \quad . \quad (9)$$

Equations 8 and 9 were applied to results for test leaves and the data extrapolated to full-scale equipment with allowances made for the uneven cake thickness and the uneven wash fluid distribution which were normally encountered in practice.

If the washing rate is low it is possible that with rotary vacuum filters sufficient washing time is not available with normal operation. A possible solution to this problem was illustrated by Purchas[20] in 1957, and a sketch of the process is shown in Fig. 4. It consisted of a multistage operation with two or more filters in series. The cake was discharged from one filter and was reslurried with fresh liquor before being passed into the next filter, and so on. Where the cakes were washed, a counter-current contact could be obtained. However, such a system is costly and would only be justified where a high recovery of the solubles was required.

Filter media

A valuable survey of the structure of filter media was made in 1956 by Grace.[21,22] The mercury intrusion method was used to study the internal structure of 10 different media.[21] The experimental data for average and maximum pore radius were found to be related to the construction variables characteristic of the media in question, and in particular to yarn construction and twist, fabric weave and fabric finish in textile type media. With woven media the pore volume was found to be distributed between inter-yarn and inter-fibre pores, and even with high twist yarns 30-50% existed as inter-fibre pores. With felt type media the pore volume existed as inter-fibre pores which were distributed over a much wider size

range than with woven media. With consolidated porous media, the size distribution of pore volume was found to be very narrow when compared to woven and felt media. The 10 media tested above were then subjected to filtration[22] with very dilute suspensions containing spherical particles of known size distribution, and the mechanism of filtration prior to the formation of a macroscopic cake was studied. Regions of " standard blocking " filtration were found to occur with each media, and these were related to the modal values of the inter-fibre pore radius of the media as measured by the mercury intrusion method. It was found that the region of " standard blocking " ended when 50-80% of the clogging value of the pore volume became filled with packed solids. An initial region of cake law filtration began when the packed volume of solids removed became 80-150% of the clogging value of the pore volume.

Wrotnowski in 1957[23] published interesting data on the properties of various non-woven filter media. These media were grouped into three types:

(*a*) Mechanically interlocked felts.
(*b*) Wool felts.
(*c*) Bonded fabrics.

Some of the more important chemical properties of the materials used are summarised in Table I. It was claimed that non-woven media, and especially the bonded synthetics, had many advantages over woven materials.

Table I. Chemical and thermal properties of various non-woven filter media.[22]

Description	*Max. concentration %**				*Max. recommended operating temperature °F.*
	H_2SO_4	*NaOH*	*Acetone*	*Petroleum*	
Mechanically interlocked felts					
Orlon	40 @ 70°F.	40 @ 70°F.	100	100	250
Dacron	70 @ 70°F.	40 @ 70°F.	100	100	300
Fibre " B " ..	50	100	100	100	240
Teflon	100	100	100	100	400
Bronze	0	0	100	100	600
Stainless steel ..	0	0	100	100	600
Wool felt					
Wool	0	0	100	100	250
Bonded fabric					
Dacron " B " ..	70 @ 70°F.	40 @ 70°F.	100	100	240
Dynel, Vinyon ..	40	40	0	100	150
Nylon " B " ..	0	40	100	100	240

* For chemical stability at maximum recommended temperature except where stated.

(1) Dimensional stability was outstanding, there was a 0·0% area shrinkage and no perceptible thickness change in chemicals or boiling water.
(2) Non-ravel properties eliminated the need for " hot-seal " cutting or " whipping " of selvedges and of drainage and port holes.
(3) Cake release properties and filter cloth life were favourable.
(4) Cloths were easy to install.
(5) There were economic advantages in initial cost, performance and life.
(6) There was little or no edge leakage because of the natural gasket action of the material.

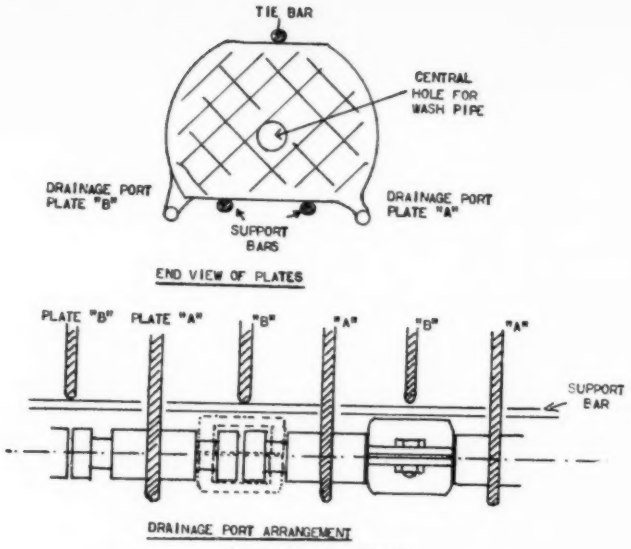
This gasket action is important for synthetic materials. With woven fabrics of natural fibres, gasket action is produced due to the swelling of the individual fibres. But synthetics do not normally swell, and unless special precautions are taken, cloths of woven synthetics will normally be subject to edge leakage. However, gasket action was one of the advantages claimed for polytetrafluorethylene (*Teflon*) cloths by Rivers and Franklin.[24] Other properties of this material, particularly its ability to withstand corrosive substances and prolonged heating to 300°C., were discussed by Hall in 1957.[25]

Equipment

Rules for the selection of a particular filter and filter medium for any process are difficult to formulate, since so much depends on the characteristics of the slurry, the requirements of the manufacturer and the traditions and practices of the particular industry. In 1955 Pratt[26] reviewed the types of equipment in use in different industries, and Table II has been extracted from this review. Further information of this type has been reported by Osgood[1] and a general article on the selection of equipment appeared in 1958.[27]

Table II. Typical industrial filter applications (from Pratt[23]).

Industry	*Process*	*Operation*	*Batch or continuous*	*Type of filter*	*Filter medium*	*Notes*
Beverages	Brewing and bottling	Clarifying	C	R.v. precoat, Plate	Kieselguhr	Polishing.
		Polishing	B	press, pressure leaf	pulp/asbestos mats	Centrifuges also used.
Light chemicals	Laboratory reagents, dyestuffs and pharmaceuticals	Clarifying	B	Nutsch, P. and f. press	Nylon, Terylene	Also small r.v. drum filters.
		Washing	C	R.v. drum, disc.	Nylon, Terylene	
		Washing	B	P. and f. press	Polythene	
		Facilitation	C	R.v. drum	Polythene	Making ribbon cake for dyeing.
Food	Sugar	Defæcation	C	R.v. drum	Metal screens	—
	Starch	Thickening and washing	C	R.v. drum	Nylon	String discharge?
	Gelatines	Clarifying and polishing	B	Leaf press	Cotton, Nylon, linters	—
				P. and f. press	pulp as admix	—
Oils, animal and vegetable	Mechanical and solvent extraction	Expelling and straining	B	Hydraulic and screw presses	Perforated screens	—
		Clarifying and polishing	B	Gravity filter	Canvas, cotton	If gravity, clay is used.
				P. and f. press	Cotton, nylon	
			B	Leaf and candle	Clay, kieselguhr	—
				Pressure filter		
Paints and varnishes	Refining	Clarifying and polishing	B	P. and f. press	Cotton, nylon	—
				Leaf pressure		
				Candle pressure	Kieselguhr	
Yeast and biochemical moulds	Fermentation	Dewatering	C	R.v. drum	Nylon, polythene	Also r.v. precoat and string discharge.
		Clarifying and polishing	B	P. and f. press		



(Source U.S. Pat. 2,878,942.)

Fig. 6. Pressure leaf filter with removable leaves.

Some changes in traditional methods have been proposed during the past few years—for example, in 1957 Bergstedt, Dahlstrom and Harms[28] proposed the application of continuous pressure filtration to the food processing field and in particular to the filtration of vegetable oils. Previously this has normally been carried out either as a batch process or on continuous vacuum rotary filters. The advantages claimed for the pressure process were:

(1) Improvement in economics by use of a continuous process.
(2) The liquid vehicles possess appreciable vapour pressures at the operating temperatures and there could be a serious loss of vehicle in vacuum filters.
(3) To achieve favourable filtration rates the pressure differential has to be higher than can be obtained with vacuum operation.
(4) The use of higher process temperature entails a lower viscosity and hence increased rates of filtration.
(5) The use of higher temperatures should eliminate crystallisation or "setting up" of the liquid vehicle.
(6) Explosion or flammability hazards may be eliminated by use of inert gas for pressurisation.
(7) There is a possibility of the economic use of process temperatures and pressures existing prior to the filtration step.

New and improved equipment

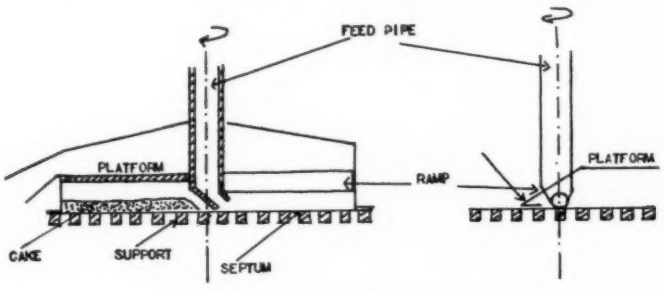
In 1956 Brown[29] proposed the use of reversible filtration. The process, as illustrated in Fig. 5, has a characteristic cyclical reversal of the direction of flow through the filtering media, without any interruption for the removal of the cake. The first portion of filtrate, formed during a given period of flow in one direction, served as a back wash to the cake deposited on the cloth during the previous period, when filtration was carried out in the opposite direction. The cake which had been washed off the cloth was cut into small pieces by backing screens and was carried out of the filter by the flow of filtrate. These small pieces of cake acted as individual particles with entirely different characteristics from the original slurry, and could easily be separated from the filtrate by standard solid-liquid separation processes. In cases where the ratio of filtrate to solids was high, the "clear filtrate" could be collected after only a relatively small portion had been used to back wash the cake and the residual feed, clear of the filtrate recovery chamber.

It was estimated that this type of filter would have definite economic advantages over, for example, the rapid sand filter.

Other designs of interest include the use of a separate "scavenging leaf" set in the bottom of a normal pressure leaf filter[30] and an adjustable wash tank for use with rotary vacuum filters.[31]

A novel pressure leaf filter has recently been described.[32] The filter had a normal arrangement of vertical leaves set in a cylindrical horizontal shell, but the leaves were separate and were supported on two horizontal bars cantilevered from the press head. The leaves were so arranged that the drainage ports from alternate leaves could be bolted together to form a continuous filtrate line, but since the leaves were separate they could easily be replaced in case of damage. The arrangement of the drainage ports, etc., is illustrated in Fig. 6 (alternate leaves drain left and right). Washing arrangements for the filter were also novel. There was a central hole in each leaf and a horizontal pipe passed through these holes for the length of the filter. The pipe was perforated, with the perforations arranged so as to coincide with spaces between the leaves, water under pressure could be applied to the pipe, which could then be rotated so as to ensure even washing of the cake.

Two recent designs have been proposed for automatic removal of filter cake. In Fig. 7[33] the filter medium was stationary and above the bed a rotating mechanism carried a shaped pipe for even distribution of the slurry and a doctor knife for removing the cake. This knife was

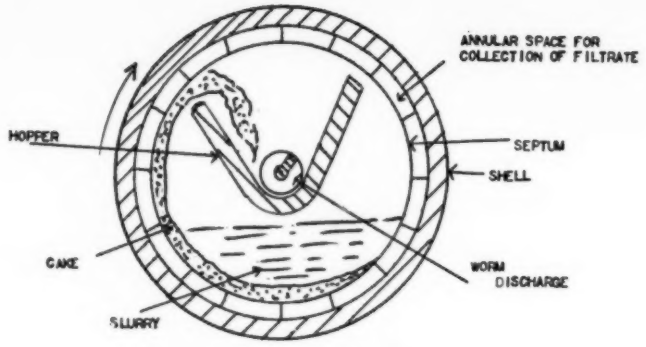


(Source U.S. Patent 2,909,286.)

Fig. 7. A continuous filter.

backed by a sloping ramp leading to a platform from which the cake was automatically discharged by a mechanical device.

In the other design[34] the cake was formed inside a rotating cylinder and discharge was by gravity into a special hopper, from which it was removed by a worm mechanism (Fig. 8). An automatic speed control for this filter was also described.



(Source U.S. Patent 2,911,098.)

Fig. 8. A continuous filter.

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33. U.S. Patent 2,909,286.
34. U.S. Patent 2,911,098.

Industry's Publications

Instruments. Negretti and Zambra have issued three new publications. (1) R30/2E dealing with electric switch and contact automatic controllers and alarm mechanisms. (2) A/19. integrating indicator (Type I.R.) for use with N & Z aircraft fuel flowmeter. (3) F25/S. Spanish version of their general catalogue.

Fine chemicals. Three technical leaflets have been published by John and E. Sturge Ltd. covering their *Aeromatt* cosmetic grade of precipitated calcium carbonate, potassium sodium tartrate and potassium hydrogen carbonate. Leaflet No. 9 deals with *Aeromatt*, which is specially manufactured for high-grade face powders, and described as a smooth and free-flowing calcium carbonate comprising calcitic particles mainly between 2 and 8 microns in diameter. Typical data is also included. Leaflet No. 30 describes and analyses potassium sodium tartrate, and Seidlitz powder. The former is available in five grades, both granular and powder. Potassium hydrogen carbonate is dealt with in Leaflet No. 31. Among the contents is an analysis table comparing typical Sturge production with the B.P. and U.S.P. limits.

Enzymes. Globe Products (Accrington) Ltd., in conjunction with their associates Novo Industri A/S., Copenhagen, have compiled a booklet entitled "Novo Enzymes." It commences with a brief survey of such features of the chemistry of enzymes as are of special importance in choosing the proper conditions of reaction, *p*H, temperature and enzyme concentration. Various methods of analysis are listed and the booklet concludes with details of each Novo enzyme preparation and the possibilities for its application.

ASTM Standards Supplements. The American Society for Testing Materials have published the 1959 Supplements to their 1958 book of standards. Together they contain over 2,600 standard specifications, methods of test, recommended practices and definitions of terms for materials. Part 10 of the 1959 Supplements relates to textiles, soap, water, atmospheric analysis and wax polishes. The 1959 Supplements can be obtained from ASTM, 1916 Race Street, Philadelphia 3, Pennsylvania, U.S.A., at $4 per part.

Aluminium chlorhydrate. A new booklet published by Albright and Wilson (Mfg.) Ltd. describes the properties and applications of aluminium chlorhydrate, used as an astringent in cosmetics. The chlorhydrate combines high astringency with suitability for use in many preparations. The leaflet includes suggestions for solutions, lotions, colognes, sprays, milks, creams, sponge-head and roll-on applicators, sticks, gels and powders. Formulations for dusting and foot powders, after-shave lotions and palmar sweat (anti-corrosion) preparations are also included. Publication of the booklet coincides with the company's opening of a larger chlorhydrate plant.

Perfumes for Cosmetics

7. DEPILATORIES

By V. Vasic, CH.E.

*With most depilatories the odour masking problem is created by hydrogen sulphide released during the decomposition of superfluous hair. Perfumes for depilatories must not only be strong enough to cope with this powerful smell; they must also be stable and inert to the depilating medium. Mr. Vasic deals with the selection of perfumes and offers illustrative formulæ.**

UNSIGHTLY hair can be dealt with by various means. It may be disguised by covering it with a flesh-coloured liquid or powder, it may be bleached, or it may be temporarily removed mechanically or by chemical action. Hair may be removed permanently by the use of high-frequency currents which set up waves akin to radio waves which are passed through a needle inserted into the hair follicles.

Great advances in the art of hair removal have been made with chemical agents in paste or cream form. Chemical depilatories induce instability with progressive loss of mechanical strength to hair shafts by the effect of alkalies and reducing agents.

Paste depilatories have not achieved wide popularity even though they destroy the hair effectively and leave the skin smooth. The active ingredient is usually barium sulphide or strontium sulphide which, in the presence of water, hydrolyses to form an alkaline solution of barium or strontium sulphydrate, the actual depilating agent. Hydrogen sulphide is an inevitable by-product of the reaction, and the presence of even a small amount of this gas gives the depilatory an odour of rotten eggs which is practically impossible to mask by any perfume.

Type of perfume

The need for a worthwhile deodorant for hydrogen sulphide has not been obviated by the advent of the newer type of cream depilatories, odourless in themselves, since hydrogen sulphide and some ammonia are always formed during the process of decomposing superfluous hair.

Although the disagreeable odour of sulphide depilatories can be covered to a certain degree providing they are carefully packed and stored, it is very difficult to cover the smell during application. Perfumes must be carefully selected and should consist only of those which are penetrating enough to tone down the smell of hydrogen sulphide. Rose types are suitable where alkaline sulphides are concerned, but there is no objection to using violet scents or another flowery note. Similarly, the fresh hay smell of coumarin, or even a fruity effect, might be well worth consideration.

Perfume stability

Stability is a difficult problem. The perfume used will have to withstand contact for a prolonged period with a medium which is powerfully alkaline (*p*H 10–12·5) and powerfully reducing, and the possibilities of interaction under these circumstances are almost unlimited.

Inorganic sulphide depilatories

Most compounds can be ruled out in the compounding of a perfume for an alkaline sulphide depilatory because of the ease with which they undergo reduction, hydrolysis, thiosubstitution and so on in the presence of alkaline sulphides.

Practically all esters will be quickly hydrolysed under the formation of metallic salts and free alcohols. Whether they are useful or useless will depend to some extent on the product of hydrolysis. If these are virtually odourless, as with benzyl acetate or methyl salicylate, they are not worth consideration. Benzyl acetate, for instance, will lose its odour completely in a few days. Linalyl acetate changes into linalool, and if the product of saponification has a perfume value, as with linalyl acetate, it can be considered.

Alcohols, in turn, are apt to form mercaptans which have a disagreeable odour, this process, however, taking place very slowly. Geraniol and citronellol are comparatively stable and may be used for perfuming.

Aldehydes, with the exception of phenylacetaldehyde and citral, are also comparatively stable. Aldehydes as a class do not form mercaptans, but they can undergo changes, such as an aldol condensation, to produce alcohols which, in turn, may form mercaptans. Alpha-amyl cinnamic aldehyde is suitable, and also hydroxycitronellal.

Nitro musks, such as musk ambrette, in benzyl benzoate oxidise sulphydryl groups and the depilatory activity of the formulation will be lost after the perfumed product is shelf-tested.

Ketones (methyl, acetophenone, ionone) and phenol ethers may be used within limits, but phenols are useless in alkaline media. Methyl acetophenone is stable and has good covering properties, but its odour is less agreeable for practical purposes.

Beta-naphthyl methyl ether (Yara-Yara), beta-naphthyl ethyl ether (Nerolin Bromelia), diphenyl oxide and diphenyl methane are among the few aromatic chemicals which are suitable for covering the odour of depilatories containing alkaline sulphides, and they do not react chemically with the active ingredients.

Thioglycollate depilatories

The choice of perfume compounds for thioglycollate depilatories is not nearly as limited as in the case of the sulphide depilatories because thioglycollates are less likely to react with perfume ingredients than inorganic sulphides. However, the high alkalinity of thioglycollates presents unlimited possibilities for reaction with perfume ingredients.

* Previous articles in this series have covered: Face Powders (July 1958), Face Creams (August), Lipsticks (October), Deodorants (June 1959), Bath Preparations (September) and Sun Tan Preparations (December).

Aldehydes in perfumes are particularly susceptible to attack from thioglycollates.

Synthetic materials comprising ethers, hydro-carbons, ketones and some alcohols offer possibilities for thioglycollates; so do natural essential oils rich in such substances. Citronella, cedarwood, petitgrain, patchouli, sandalwood, rose geranium and vetivert oils are suitable for thioglycollate depilatories.

Perfume compounding

Only powerful perfume materials, such as diphenyl oxide, camphor, eucalyptol or the ionones, are capable of dominating the odour of sulphide preparations. Caraway oil very satisfactorily covers the odour of hydrogen sulphide by entering with it into a crystalline formation without materially decreasing the efficacy of the depilatory. Another satisfactory covering agent is oil of cedar leaves, but unfortunately its odour is generally not liked for depilatories.

Petitgrain oil adds an agreeable note to the perfumes for depilatories and is quite useful. Perfume compositions based largely on ionones and the rose alcohols, such as geraniol and citronellol, have proved to be very satisfactory for perfuming thioglycollates, and some of them have shown excellent stability.

It is possible to subdue the basic depilatory odour by using *Versalide* (polycyclic musk), which has a tendency to depress the unpleasant odour allowing the fragrance blend to have a dominating effect. The use of *Versalide* permits one to make a selection from a wider range of odour types.

When removing the depilatory a certain burnt odour remains which may be covered by suitable addition of patchouli, vetivert and sandalwood oils to perfume composition.

Concentration of perfume

It is useless to attempt to cover the disagreeable odour of a depilatory by an excessive addition of perfume. Many perfumery materials are more likely to cause a deterioration than an improvement of the odour if used in excess.

The amount of the perfume compound in sulphide depilatories depends on the quality of sulphide, but usually 0·5 to 2% is sufficient.

Thioglycollate depilatories may be perfumed with less perfume and about up to 1% is required.

Perfume S.V. 26

For a depilatory cream of the sulphide type

	%
Geranium oil, Bourbon	19·4
Bergamot oil	19·3
Bois de Rose oil	19·3
Geraniol	19·3
Coumarin	9·7
Camphor, natural	13·0
	100·0

Perfume S.V. 27

For a depilatory cream of the sulphide type

	%
Geranium oil, Bourbon	29·2
Geraniol	17·4
Citronellol	10·9
Phenyl ethyl alcohol	10·0
Linalool ex Bois de Rose	7·0
Cinnamic alcohol	1·7
Geranyl formate	0·5
Alpha-amyl cinnamic aldehyde	0·5
Sandalwood oil, Mysore	2·0
Cedarwood oil	3·0
Anisic aldehyde	4·3
Diphenyl oxide	0·5
Camphor, natural	13·0
	100·0

Perfume A.P. 13

For a depilatory cream of the thioglycollate type

	%
Azurial, Givaudan	30·0
Spike lavender oil, Spanish	20·0
Citronellol	20·0
Irisone pure	10·0
Lilial, Givaudan	10·0
Phenyl ethyl alcohol	5·0
Geraniol	5·0
	100·0

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Perfume and Fl

FIRMENICH'S NEW LABORATORIES IN GENEVA

Two types of analytical work are carried out; first, research on essential oils and natural flavours with the object of compounding such substances by the use of synthetics alone. Second, research on new synthetic products.

The two classes of work demand totally different investigators and laboratories. The creation of new synthetic products is much less difficult than the separation and analysis of natural products, but the chances of discovering a good product are very slight.

For this reason the laboratories concerned with natural products are the principal ones in the new building. Auxiliary laboratories for micro-analysis, spectrography, gas chromatography, etc., have also been provided.

For the second class of research, laboratories have been provided which permit work on a larger scale. In them compounds are prepared which are not to be found on the market. A wide range of preparative techniques is used, so these laboratories are used, among other things, for training staff.

The new building also includes a pilot laboratory. Here, new products are studied, new methods are applied to old processes, and the extracts for research are produced from raw materials.

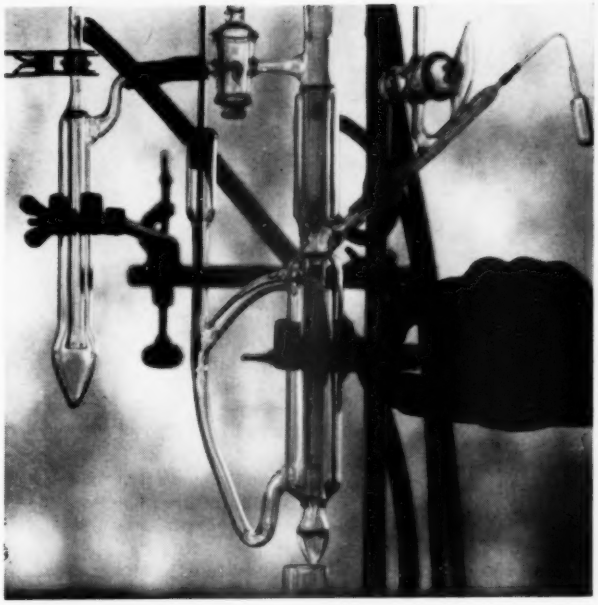
Besides the laboratories, essential services such as stores, mechanical workshop facilities, equipment washing and glass blowing are included in the new building. A large library has also been installed as a necessary part of research.

The organic research laboratories

The organic research laboratories are divided into units based on the principle of work by teams. All the principal laboratories have the same

nd Flavour Research

The new research laboratories of Firmenich and Co. in Geneva are the direct result of the advances now being made in analytical chemistry. The new buildings are attached to the existing laboratories in the centre of the plant. Installations have been standardised as far as is compatible with the varying requirements of different research units.



An intricate piece of distillation apparatus used in the preparation of synthetic flavours and perfumes.

equipment and each is designed for the needs of one chemist and two to four assistants.

Large, dust-proof windows provide plenty of daylight and this can be regulated with Venetian blinds between the double panes. Hoods and work benches are placed so that several people can work independently but still be under supervision of the senior chemist.

Hoods are light and made of a non-corrosive material. As they cause little obstruction of the light, large ones have been installed, which allow work on three sides. The laboratory tables have a metal framework which supports the pipes and cables, and the tops are *Formica* covered. The surfaces are divided into standard units, varied and interchangeable, so that each chemist can choose the arrangement he considers best for his work. A special unit consists of a tray which is adjustable in height and is useful for setting up special apparatus.

A bench for micro-research is installed facing north; this has a dull black *Formica* surface to facilitate this type of work.

The laboratory equipment is completed by a small bench, an electric drying oven, a refrigerator, a steam bath and a vibration-proof table for the balances. Throughout the laboratory at convenient points are installed single phase and triple phase current, hot and cold water, steam, vacuum, nitrogen, compressed air and demineralised water.

The ventilation system allows the introduction of dust-free, humidified and chilled or heated air according to the season. A proportionate evacuation of air takes place through gratings and hoods, maintaining a slight vacuum in the laboratory and eliminating smells. The laboratory is heated by ceiling radiation.

The chemical apparatus itself includes automatic balances, centrifuges, various models of magnetic mixers with or without heat, a melting - point microscope, a revolving evaporator, a mobile low-temperature refrigerating system with a cooling bath and circulating pump, etc.

The chemist himself has a small office connected with the laboratory and separated from it by a large glass panel.

In addition, a " night room " is attached for experiments which must continue day and night without supervision. For safety this room has only one door leading to the corridor and a glass inspection panel.

For very dangerous experiments each floor has a strong room, equipped in the same way as the laboratories, but with the addition of a special safety window and an automatic carbon dioxide extinguisher. A balcony equipped with a work table makes it possible to carry out malodorous experiments in the open air, as even the best hoods cannot cope with some of the bad odours that must arise.

Other facilities which are at the disposal of every chemist are the hydrogenation laboratory, autoclave laboratory, a room for shaking machines and a small mechanical workshop.

General view of the new Firmenich laboratories.

Physical chemistry department

In this department are grouped three laboratories connected with pure physical chemistry. They are the micro-analytical laboratory, the spectrographic laboratory and the laboratory for assembling chemical and physical apparatus.

The micro- and macro-analytical laboratory utilises such methods as *p*H measurement, titrimetry, colorimetry, polarimetry and the classical combustion methods of analysis. The spectrographic laboratory includes equipment for infra-red and ultra-violet work, as well as apparatus for gas phase chromatography. A fully equipped dark-room for all photographic work, which serves also for optical measurements, completes this first group.

Study of new apparatus

The laboratory for assembling physical and chemical apparatus is intended primarily for the study and construction of new electronic, optical and mechanical apparatus necessary for the special needs of the physical chemistry department and of the research laboratories in general. This laboratory also has a small mechanical workshop.

The department is to be completed later by the addition of a unit designed for work with isotopes.

Attached to the physical chemistry department there is a laboratory for the purification of solvents. The work done here is directly connected with that done in the main physical chemistry laboratories, and as purification is generally carried out by distillation, it is here that new apparatus is evolved. A completely automatic fire extinguishing system covers the laboratory.

Paper chromatography

The paper chromatography laboratory is divided into two parts. In the first part, where the different papers are stocked and the chromatograms are prepared, the equipment is the same as in the standard laboratories, but with the additional installations necessary for this kind of work. Air conditioning apparatus is installed capable of maintaining a relative humidity of $\pm$ 5%. A large stock of chemicals for comparative work are stored here, and also a quick-working semi-micro balance.

Two areas are equipped for the preparation of chromatograms. Apparatus for the quick drying of the papers by air draught is installed, and all impregnation work is carried out under hoods. A small dark-room is available for ultra-violet examination of the chromatograms.

In the second part of the laboratory, which contains the chromatograph chambers, the temperature is maintained at 25$\pm$1°C. The chromatograph chambers are placed on shelves with a neon light behind so that progress of the mobile phase can be observed. A specially ventilated oven facilitates drying of the finished chromatograms.

The pilot laboratory

This is spacious and occupies two floors. Between the two floors an opening makes possible the installation of columns, etc. An inclined unloading ramp facilitates the entry of equipment, whilst heavy material is placed in position within the laboratory by block and tackle. With a view to giving this laboratory the greatest possible scope, it is provided with every type of power and the same equipment as other laboratories and workshops. Its presence in the same building as the research units gives it the advantage of proximity to the analytical laboratory, the library and the mechanical workshop.

Although the extent of these new research laboratories may seem surprising and out of proportion to the factory, it must be remembered that in very few industries is progress so closely linked to research as in the manufacture of synthetic perfumes.

Interior of the organic research laboratories showing one of the large hoods with access on three sides, and also the spaciousness of the work benches.

Scientific instruments. The latest edition of the well-known Pye Scientific Instrument Catalogue describes several important new developments which will interest all those concerned with scientific research or industrial production testing and process control. Catalogue N is distinguished by its orange cover and it supersedes all previous editions.

Electrostatic precipitation. An illustrated folder, Publication 7020, from Sturtevant Engineering Co. Ltd. gives a brief outline of some of the applications and advantages of their electrostatic precipitators. Uses include the recovery of materials from stack gases and the elimination of dust and mist from processes. This supersedes Publication No. 7010.

Laboratory heating equipment is the title of a new illustrated catalogue from Electrothermal Engineering Ltd. The extensive list covers heating mantles, special flexible mantles, electric " Bunsens," extraction apparatus (Soxhlet and Kjeldahl), immersion heaters, pipe heaters, heating tapes and " Flexible Furnace " material. In the apparatus section the new melting-point apparatus and paraffin section mounting bath are described, and larger plant and special heating equipment are also mentioned.

ANTIBIOTICS

By G. Shaw,* A.R.I.C.

Broth analysis ● Interferon ● Colistin ● Vancomycin ● Cephalosporins N and C.

Automatic analysis of broths

IN THE production of antibiotics by fermentation there are many variables affecting both the course of events and, perhaps most important of all, the yield of the desired product. Investigation into the part played by these variables, with a view to their control and manipulation to give optimal output, requires extensive and varied analytical work.

The analysis of fermentation media is time-consuming and expensive. So it is not surprising that several methods for automatic or semi-automatic analysis of penicillin and streptomycin "broths" have recently appeared in the literature.

The known colorimetric methods for determining streptomycin and penicillin are well suited to automation. The presence in fermentation broths of both side-products and excess nutrients makes it necessary to include steps of partial purification in the analytical methods if accurate results are to be obtained; provision has consequently to be made for these steps to be included in any automatic process. Green and Monk[1] have described a semi-automatic method for determining penicillin in broths. Their method depends upon the decomposition of penicillin, selective extraction with a solvent and addition to the extracted material of other reagents to form a coloured solution.

The method requires accurate measurement of seven reagents, a liquid/liquid extraction, evaporation of a solvent and determination of an optical density. The system involves use of seven pipette units, a transfer pipette unit and an automatic absorptiometer. The operator uses a standard steel rack, containing thirty B.14 stoppered tubes, inserted into the appropriate pipette unit in which the reagent is dispensed into three tubes. When an indicator light flashes, the rack is pushed further into the unit, and the process is repeated. The time taken to add 10 ml. of reagent to 30 tubes is 90 sec. All the reagents and the solvent are added in a similar manner.

After shaking on a conventional reciprocating machine, the rack is coupled to a second rack of tubes to which one of the reagents has already been added in a pipette unit, and the combined racks are inserted into a transfer unit in which a portion of the solvent extract in the tubes in the first rack is withdrawn and transferred to the tubes in the second rack. After evaporation of the solvent by jets of filtered air at 60°C. the other reagents are added as before. When colour development is complete the tubes are pushed individually into an absorptiometer, which determines and records the absorbance automatically at a rate of about 250 tubes/hr.

The precision of the assay carried out in this way is $\pm 2{\cdot}5\%$; since the equipment has been in use two unaided assistants with no scientific background have been able to perform 400 penicillin assays a day, for which otherwise five or six trained assistants would have been required.

A. Ferrari, F. M. Russo-Alesi and J. M. Kelly[2] have described a fully automatic system in which all the necessary reagents and the sample under test are delivered into a continuous flow system by a single peristaltic pump operating several tubes. The volume ratios of reagents and sample are governed by the diameters of the tubes. Provision is made for incorporating into the stream any number of heating, cooling, time delay and mixing units. The final stage of the system is an automatic strip-recording absorptiometer in which the colours of the test solution and a known standard are compared (Fig. 1). An important feature is the inclusion of a dialysis cell by means of which partial purification is achieved. Use of the apparatus for streptomycin and penicillin assays was also described.

For streptomycin a product of its alkaline decomposition is partly dialysed into a stream of reagent with which it forms a soluble coloured complex, and this solution then passes to the absorptiometer. In the assay of penicillin a product of its enzymatic decomposition is partly dialysed into a stream of standard buffered iodine solution whose colour becomes less intense owing to chemical reaction. This solution is then delivered to the absorptiometer. Up to 60 samples an hr. can be analysed in this apparatus. The overall error of the determinations is reported as $\pm$ 3-4%, and this is claimed to be less than the error encountered in routine determinations by current methods. The time taken for analyses has thus been greatly reduced; the authors state, moreover, that work is in progress on the integration of this system into fully "automated" fermentation processes.

Interferon—a viral antibiotic

The prospects of a viral antibiotic becoming available for use in human infections seem to have improved considerably during the past three years as a result of work in several laboratories arising out of the discovery by Isaacs and Lindemann,[3] during their investigation of the virus interference phenomenon, of a substance now named interferon.

It had been known for some time that a virus, even if inactivated, would interfere with the growth of other unrelated viruses within the cell. This knowledge appeared to have no practical applications, since large doses of inactive virus may prove toxic. Isaacs and Lindemann found that when the interfering virus was incubated with cells in a simple supporting medium a substance was formed in the cells and was released into the medium, from which it could be isolated. When injected into animals it offered protection against viral infections.

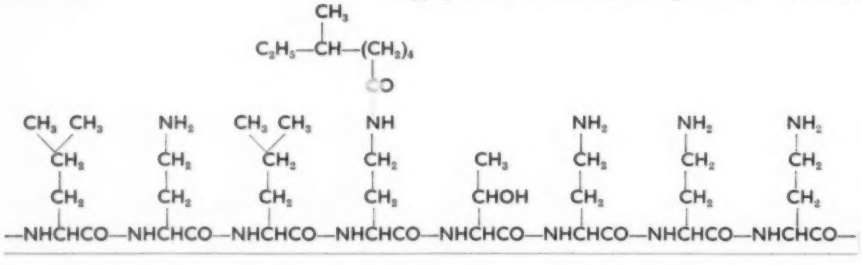
* Glaxo Laboratories Ltd.

This substance—interferon—is a protein with apparently a wide antiviral spectrum, although viruses differ in their susceptibility to it. All the evidence available indicates that it is non-toxic, and repeated administration to animals has not resulted in the production of antibodies. Its activity can be measured by methods similar to those normally used for antibiotics.

Cellular specificity of interferon has been demonstrated by Tyrrell.[4] Interferon prepared on chorio-allantoic membrane infected with an influenza virus was much less effective against infection in calf kidney cells than against infection in chorio-allantoic membrane. Isaacs and Westwood[5] showed that interferon prepared in rabbit kidney was more effective than that prepared in chick fibroplasts in protecting rabbits against vaccinia virus. This suggests that interferon required for the protection of human subjects against virus infection might have to be prepared in human cells or in those of a closely related primate.

During studies of the protective action of interferon against virus infections in animals Isaacs[6] showed that, provided the infecting dose is small, as it usually is in natural infections, then its administration at an early age gives protection. There is no evidence that interferon, like the known antibiotics, is effective against any established infection. Interferon, unlike these antibiotics, is a natural product of the body cells at a time of infection; thus its use in therapy would seem to be an extension of normal bodily defence processes.

Colistin



Since salmonella and shigella are among pathogens for which effective antibiotics are continually being sought, the recently described results obtained with colistin are encouraging.

Colistin is a polypeptide antibiotic, first isolated in 1950 by Koyama and his associates from cultures of a new species, *Bacillus colistinus*. It has been used in clinical trials in Japan, Italy and France during the past 10 years and is now being studied in some detail by American clinicians. Colistin has aroused particular interest as, unlike other polypeptide antibiotics, it appears to be completely non-toxic.

Chemical studies[7] have shown that colistin is a basic cyclic polypeptide composed of five moles of α-γ-diaminobutyric acid and one mole each of 6-methyloctanoic acid, l-threonine, l-leucine and *d*-leucine. It resembles the polymyxins and circulin in structure. The basicity of the antibiotic is due to the free γ-amino groups of four molecules of the α-γ-diaminobutyric acid, another functional group being provided by the hydroxyl group of the l-threonine. The salts of colistin are stable at elevated temperatures in the solid state, but solutions of the salts are relatively unstable above *p*H 6 at room temperatures. Colistin is available commercially as colistin sulphate and colistin methane sulphonate.

In vitro laboratory studies show that both colistin sulphate and colistin methane sulphonate demonstrate bactericidal and bacteriostatic activity against a variety of Gram-negative organisms such as *Escherichia coli*, *Klebsiella pneumoniæ*, *Pseudomonas spp.*, *Salmonella spp.*, and *Shigella spp.* Both also show slight activity against *Proteus spp.*, Gram-positive organisms and fungi.

Animal trials[7,8] *in vivo* have shown that both are well tolerated by mice, rats and dogs at levels up to 7·5 mg. base per kg. daily for 60 days.

Wright and Welch[8] have reported that intramuscular injections of 0·2–2 mg/kg. colistin methane sulphonate were well tolerated in man and produced peak serum levels 2 hr. after injection; with the highest doses colistin was measurable in the serum 24 hr. after injection. McCabe *et al.*[9] have, however, shown that colistin methane sulphonate is absorbed poorly and irregularly from the intestinal tract. They found that 10 out of 17 patients with chronic urinary tract infections showed a significant clinical and bacteriological response after its intramuscular injection. Further clinical trials with children[10,11] show that the methane sulphonate is also effective in the treatment of pathogenic *E. coli* gastroenteritis and in the treatment of acute diarrhœa in infants under one year old.

The relative lack of toxicity of colistin sulphate and colistin methane sulphonate, and the encouraging clinical results so far reported with these forms of the antibiotic, show that they could be useful antibacterials.

Resistant staphylococci

The emergence of staphylococci that have developed resistance to antibiotic therapy is a continual and growing problem in medical institutions. It has stimulated considerable effort into the search for antibiotics effective against these organisms: two that appear promising are vancoymcin and cephalosporin C.

Vancomycin

Vancomycin is a complex antibiotic that has been known for five years, but has not yet achieved any widespread use.

Vancomycin was first isolated by McCormick [12] and his co-workers in 1956 from the fermentation broth of a species of *Streptomyces orientalis*. It is a water-soluble amphoteric compound, with an isoelectric point of 5 and a molecular weight of 3300 (sedimentation method). Little is known of its structure; the hydrochloride contains 7% nitrogen and 16–17% of carbohydrate.

Preliminary clinical studies with vancomycin gave encouraging results and led in 1956-57 to more thorough *in vitro* and animal trials. These showed it to be strongly bactericidal at low concentrations, particularly against Gram-positive organisms. Further clinical trials confirmed these observations and showed the antibiotic to be effective against staphylococci infections resistant to other antibiotics. Kirby *et al.*,[13] reporting on a clinical study of 32 patients with severe staphylococcal and streptococcal infections, stated that "vancomycin is probably the best single agent available at present for the treatment of severe staphylo-

Fig. 1. Components of automatic analyser. From right to left, sampling unit, dialyser, heating bath (to rear), colorimeter and recording unit.

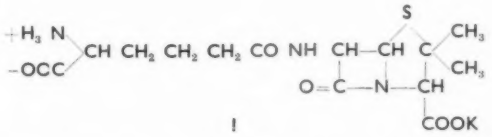
coccal infections." The chief disadvantage of the antibiotic is the need to administer it as an intravenous drip, since chills, fevers and rashes occur in some patients in an unpredictable fashion when it is introduced quickly. The duration of treatment ranged from 6 to 35 days; in many patients there was an immediate response, associated with a fall in temperature and marked subjective improvement in 24 to 48 hr. In a more recent report Kirby *et al.*[14] have stated that vancomycin has been used in one hospital for more than three years without any resistant staphylococci being encountered.

It is likely that vancomycin will play an increasing part in the treatment of staphylococcal infections, as staphylococci appears to be generally susceptible and incapable of producing vancomycin-resistant strains. As it is bactericidal, and as high serum and tissue concentration can readily be attained, its only limitations reside in the difficulty of its administration and its slight side effects.

The cephalosporins

Cephalosporins N and C are antibiotics of the penicillin family, produced by a species of cephalosporium first obtained in Sardinia; cephalosporin N, known in the United States as synnematin B, is also found in the fermentation liquors of *Cephalosporium salmosynnematin*. Both compounds are considerably less active against *Staph. aureus* and much more active against *Salmonella typhi* than is benzylpenicillin.

Cephalosporin N has been used successfully in the United States for treating typhoid fever,[15] but not to any great extent in clinical medicine owing to economic difficulties that have so far hindered its production on the commercial scale. Its structure was established as D(4-amino-4-carboxy-n-butyl) penicillin (I); it gives D-α-aminoadipic acid and D-penicillamine on treatment with acid and is hydrolysed rapidly by *Bacillus cereus* penicillinase in the same manner as benzylpenicillin.

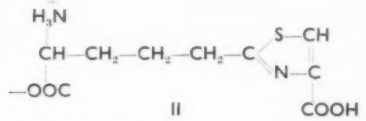


I

The zwitterion character of the side-chain gives cephalosporin N a marked hydrophilic character, which distinguishes it from the other natural and biosynthetic penicillins.

Cephalosporin C, produced in very small amounts together with cephalosporin N, has not yet been reported on in the treatment of human disease. Florey[16] has shown that it is virtually non-toxic and affords protection against penicillinase-producing staphylococci in mice. It has not yet been characterised completely, but it is known that, like cephalosporin N, it contains sulphur and a D-α-aminoadipic acid residue in the molecule. Newton and Abraham[17] have shown that it is relatively stable at *p*H 3 and at room temperature. They found that it does not yield penicillamine on acid hydrolysis, although it does give valine after acid treatment, when sulphur is removed from the molecule by Raney nickel. This suggested that the nucleus does not contain the characteristic 4 - carboxy - 5·5 - dimethylthiazolidine nucleus of the true penicillins.

Abraham and Newton[18] have reported that cephalosporin reacts slowly at 37°C. with aqueous pyridine and various substituted pyridines, to give a series of biologically active compounds. More recently, Jeffery, Abraham and Newton[19] have isolated an acidic compound from the reaction mixture of aqueous pyridine and cephalosporin C and from an aqueous solution of sodium cephalosporin C kept at 37°C. The structure of this acidic compound was confirmed as 2 DL-4-amino-4-carboxyl butyl thiazole-4-carboxylic acid (II) by the unequivocal synthesis of identical material.



II

It is recognised that this thiazole cannot be present in cephalosporin C, as this does not give D-α-aminoadipic acid on treatment with hot dilute acid, and it is suggested that it arises by hydrolytic cleavage of the antibiotic. A knowledge of the means whereby this rearrangement is accomplished could lead to the identification of a penicillin-like nucleus that is acid-stable and penicillinase-resistant. Such an antibiotic might be of considerable clinical interest if it could be produced economically on the large scale.

The work carried out on the structure of cephalosporin C by Florey's group at Oxford and the M.R.C. Antibiotics Research Station at Clevedon has interested British and American firms, according to the last report of the National Research Development Corporation.[20] Patent coverage has been taken out for many stages in the production and extraction of the antibiotic by the Corporation, with the comment that " cephalosporin C or compounds closely related to it may have considerable value in medicine."

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(*Continued on page* 360)

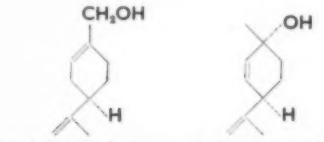
PERFUMERY and Essential Oils

By A. J. Krajkeman,* DIPL.ING.CHEM., F.R.I.C.

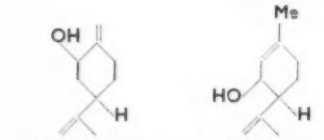
Perilla ● Palustrol ● Orange peel flavone ● Elssholtzia oil ● Cinnamon odour ● Labdanum ● Costus root oil ● Indian essential oils ● Conifer oil constituent ● Synthetic aromatics ● Analysis ● Reviews

Perilla

PERILLA alcohol is contained in ginger grass oil and in the oil of *Cymbopogon densiflorus* Stapf. Three additional alcohols have now been found in these oils,[1] (+) - *cis* and *trans-p*-menthadiene-2,8-ol-1, (+) - *cis-p*-menthadiene-1 (7), 8-ol-2 and probably *iso*piperitenol.

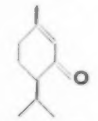


(+)-Perilla alcohol — (+)-cis-p-menthadiene-2,8-ol-1



(+)-cis-p-menthadiene-1(7),8-ol-2 — cis or trans isopiperitenol

A new variety of perilla was found in Taiwan.[2] It is the so-called " Egoma," *Perilla frutescens* Brit. var. *typica Makino*, and the essential oil obtained from it is quite different from that of " Ao-Shiso," *P. frutescens* Brit. var. *crispa Decne*. The new oil contains 31% of (−)- limonene, 6% of α-caryophyllene, 55% of (−)-piperitone and 0·5% of piperityl formate, but it contains no perilla aldehyde.

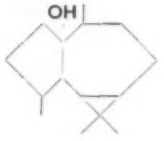


Piperitone

Perilla aldehyde

Palustrol

A liquid sesquiterpene alcohol has been isolated from Carqueja oil which has been identified as palustrol and the following structural formula has been assigned to it.[3]



Orange peel flavone

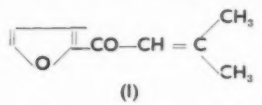
The flavone separated from orange peel has now been identified as 3′,4′,5,6,7 - penta - 0 - methyl flavone by chemical degradation and ultraviolet and infrared spectroscopy.[4]

Elssholtzia oil

Until recently the oil of labiated *Elssholtzia cristata* was little more than a curiosity. Lately it has been produced in and exported from China and has attracted attention both for its composition and its application in perfumery. The latter is the subject of an article which describes the odour effect of the oil[5] and gives a number of perfume formulæ which make use of it, including formulæ for rose, carnation, eau de cologne, lavender, etc.

Continuing their work on the essential oil of *Elssholtzia oldhami* Hemsl. (=*E. formosana* Hay), Naves and co-workers have purified β-dehydro-elssholtzione (I) by means of its sodium-bisulphite addition compound.[6] The Kishner-Wolff reduction of elssholtzione (II) has given methyl - 3 - (methyl - 3 - butyl) - 2 - furane (III) which has been hydrogenated to give a mixture of *cis* and *trans* 3 - methyl - 2 - isoamyl tetrahydro furans (IV).

It is interesting to note the close relationship between this group of compounds and the so-called " rose oxide " (V). This product which is 3 methyl - 2 - (3 - methyl - butenyl - 2)-tetra-hydrofuran, was found in rose oil by Seidel and Stoll and reported in a recent Progress Report.



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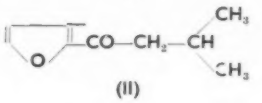

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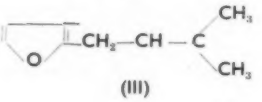

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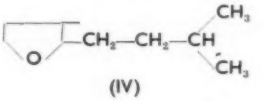

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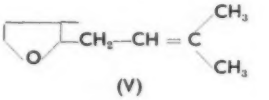


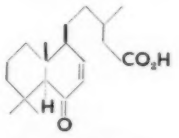
(V)

Cinnamon odour

It has been found that the cinnamon-like odour of the oil obtained from the bark of *Aniba Canelilla* (H.B.K.) is due to 1-nitro-2-phenylethane.[7] This substance occurs in the oil in the remarkably large quantity of 80%. Other constituents found are eugenol (1%) and eugenyl methyl ether (15%).

Labdanum

In addition to labdanolic acid a new acid has been found in the acidic fraction of gum labdanum.[8] It has been identified as 6-oxocativic acid or 6-oxolabd-7-en-15-oic acid.

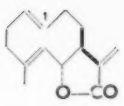


6-oxocativic acid

Costus root oil

This oil has been found to be unusually thermolabile. In order to separate the true constituents a process had to be evolved[9] in the course of which the oil is not subject to temperatures above 40°C. A number of constituents have thus been isolated, dehydrocostus lactone and costunolide accounting for 50% of the oil. Structural investigations on other constituents found during this work will be published later.

* Söflor Limited.



Costunolide

Indian essential oils

Tumru or *Zanthoxylium aromatum* Alatum is a shrub which grows widely in India. Although the essential oils from the fruits and the bark were studied as long ago as 1910, the oil obtained from the leaves has not been examined until now.[10] It is obtained in a yield of 0·04% and contains 44% carbonyl compounds, 19·5% alcohols, approximately 11% of ethers and 13% sesquiterpenes. The main component is methyl nonyl ketone, linalool is the alcohol and linalyl acetate the ether.

Amomum subulatum Roxb. grows mostly in the eastern Himalayas. The fruits are a cheap and efficient substitute for cardamoms. From the seeds an oil was obtained in a yield of 2·5% which was found to have the following composition[11]:

	%
Sabinene	6·6
Cineole	64·9
Terpinene	10·7
Terpineol	7·1
Terpinyl acetate	5·1
Bisabolene	3·6
Polymeristion products ..	1·9

Conifer oil constituent

All conifer woods possessing the sweet odour of "pencil wood" apparently contain thujopsene, a hydrocarbon for which a correct formula is now suggested.[12]

Thujopsene

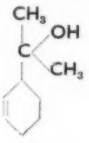
Synthetic aromatics

An excellent review by Naves on recent industrial developments in the field of synthetic aromatics has now been published.[13] It deals mainly with synthetic routes leading to such products as geraniol, nerol, linalool, citral, etc. After an introduction of a general nature the author discusses the subject under four different headings, classified according to the starting material used: syntheses starting from β-pinene via β-myrcene, syntheses starting from isoprene and syntheses starting from methylheptenone.

A British Patent[14] covers the cyclisation of pseudoionone to ionones. It claims that when diisopropyl ether is used as the diluent and the reaction is carried out at 0°-5°C. the reaction mixture consists of almost pure β-ionone.

Lævorotatory β - hydroxy - β - phenylbutyric acid has been prepared by the Reformatsky reaction from either (−) - bornyl bromo-acetate or (−) -*d*-fenchyl bromoacetate and acetophenone in presence of zinc wool.[15] (−) - Menthyl (+) - β - hydroxy - β-phenyl butyrate has been obtained optically pure, and on hydrolysis it gives the optically pure acid in a 90% yield.

Under irradiation various carbonyl compounds react with cyclohexene to give alcohols.[16] If, for example, acetone dissolved in cyclohexene is irradiated the alcohol (I) is obtained.



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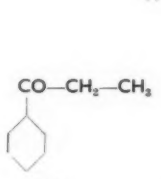

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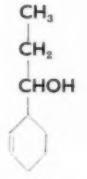
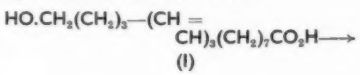


(III)

An elegant synthesis of dihydrocivetone and cyclopentadecanone makes use of kamlolenic acid (I) as the starting material.[17] This acid is the main constituent of Kamala seed oil (*Mallotus philippinensis*, Muell, Arg.).

ω-hydroxystearic acid (II) is prepared by hydgrogenation and the methyl ester (III) is acetylated to (IV). Treatment with phenyl magnesium bromide yields the diol (V) which is dehydrated to the alcohol (VI). On oxidation of this alcohol with chromic acid pentadecane - 1 : 15 - dicarboxylic acid (VII) is obtained. The diethyl ester of this acid is cyclised by the acyloin method and the resulting acyloin is reduced to dihydrocivetone (VIII). By the Barbier-Wieland degradation of the diethylester of Compound (VII), tridecane-1 : 13-dicarboxylic acid (IX) is obtained, the diethyl ester of which yields cyclopentadecanone (X) on cyclisation and reduction.



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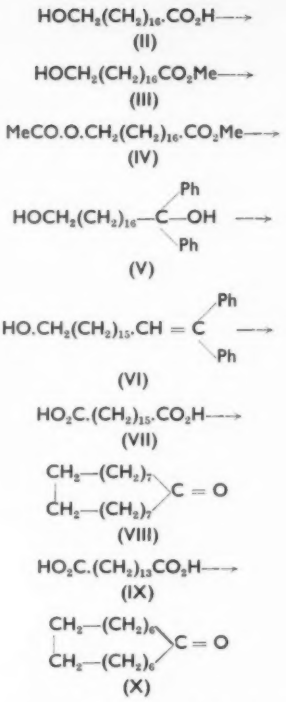
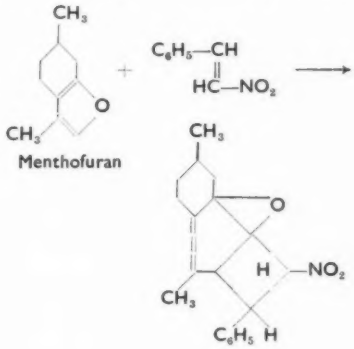
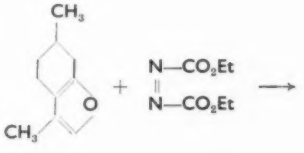


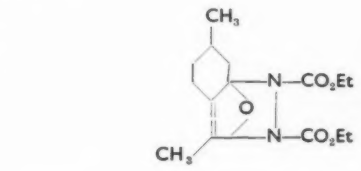
The process is covered by Indian Patent No. 59927 (1957).

It has been found that menthofuran, unlike furan, undergoes Diels-Alder reaction with nitroalkenes and azodicarboxylic acid diethyl ester[18]:

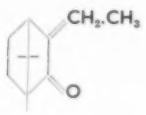


Menthofuran





The reaction product of methyl magnesium iodide and 3-hydroxymethylene-(+)-camphor has now been identified to be 3-ethylidenecamphor[19]:



Analysis

Reviews of fundamental developments in analysis have now been published for 1959.[20] The most interesting among the 12 chapters in relation to essential oils and perfumes are those on chromatography and gas chromatography. Four hundred and sixty-two literature references are discussed in the former, and in the latter the reviewer deals with 244 published papers.

The determination of secondary alcohols in the presence of primary alcohols has been achieved by a colorimetric method.[21] It relies on the oxidation of the secondary alcohols to ketones by acid potassium dichromate, which oxidises primary alcohols to acids under the conditions of this method. The ketone is determined colorimetrically by a 2,4-dinitro-phenyl hydrazine technique. The method is also applicable to the determination of ketones in the presence of aldehydes.

Wax-like constituents of civet and of a number of concrete oils can be separated in the form of their urea adducts. This property is utilised in a new analytical technique for the quality control of concretes and the determination of the steroptene content of rose oil.[22]

Large volume gas liquid chromatography has been used for the separation of isomeric C_8 aldehydes.[23] The separated isomers were identified by a combination of nuclear magnetic resonance and infrared spectroscopy. They were then reduced to hydrocarbons which were identified by comparing their gas liquid chromatograms with standards.

Capillary columns of 0·01 in. bore and 100 ft. in length have been successfully used for the separation of essential oil terpenes.[24] The columns were coated with squalene, Apiezon, Carbowax and Ucon. These columns have also been found superior to packed columns for the separation of the terpene alcohols fractions of essential oils.

Reviews

An interesting survey of the bergamot industry has been published by Prof. La Face, who is the director of the Stazione Sperimentale per l'Industria delle Essenze e dei Derivati Agrimari at Reggio, Calabria.[25] He deals with the history, cultivation and varieties of the bergamot tree and gives a detailed description of the processes used in the manufacture of bergamot oil.

Bedoukian's annual reviews on the progress of perfumery materials are well known by now. The review for 1959 again makes interesting reading, dealing as it does with 249 published papers.[26]

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HORMONES

By R. M. Evans,* D.Sc., F.R.I.C.

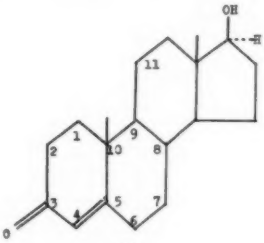
Anabolic agents ● *Hormones and animal growth* ● *Aldosterone*

Steroids: modified androgens as anabolic agents

THE organs and tissues of the human body are being continuously broken down and simultaneously rebuilt from different fragments; in the healthy adult these opposed processes are in equilibrium. The balance can be upset by many factors including diseases, injuries, and surgical operations, which cause an increase in the rate of tissue destruction (catabolism) relative to the rate of tissue replacement (anabolism). The resulting negative protein balance is made apparent by loss in weight, and in the care of the convalescent patient the value of high protein diets to redress this depletion has long been recognised. But it is not always possible to arrest protein depletion by dietary control, and a therapeutic agent to accelerate protein synthesis would clearly help to speed convalescence after acute illness and, in chronic conditions, reduce deterioration in general health.

* Glaxo Laboratories Ltd.

Twenty-five years ago Kochakion and Murlin[1] demonstrated that the steroid hormone, testosterone (I),



(I)

besides possessing its well-established androgenic action, caused nitrogen retention as a result of an increase in rate of protein synthesis. The use of testosterone (I) and its esters as anabolic agents is limited, however, because of their pronounced virilising action, and during the past 15 years chemists and biologists in many laboratories have been searching for compounds having the required effect on anabolism, but devoid of androgenic action. These have been

sought principally among the structural analogues of testosterone; complete separation of anabolic and androgenic activity has not yet been achieved, but it has been found that the former is less sensitive to structural changes than is the latter, and for the purpose under consideration compounds vastly superior to testosterone have been synthesised.

Both anabolic and androgenic activity can be measured on castrated rats as test animals.[2] The anabolic activity may be assessed by measuring the relative increase in weight of the *levator ani* muscle of the treated animal over that of the control, and the androgenic action by comparing similarly the relative increases in weight of the ventral prostate or the seminal vesicles.

The $\frac{\text{anabolic activity}}{\text{androgenic activity}}$ ratio will indicate the degree by which these two properties have been separated; the factor by which it exceeds the ratio observed for testosterone may be termed the "anabolic enhancement factor."

By 1951 two promising compounds had been discovered. The first was methylandrostenediol,[3] which showed appreciable anabolic enhancement; the dihydro analogue of testosterone, methylandrostanolone,[3,4] proved even better. From 1951-57 work in this field, as in all other branches of steroid chemistry, was stimulated greatly by the concurrent researches into syntheses of the adrenal cortical hormones and their structural analogues. The range of accessible testosterone analogues was greatly increased by the new knowledge, and "androgenic enhancement factors" as high as 100 have been reported for some of the most recently described compounds.[3] The effects on anabolic and androgenic activity brought about by structural modification of the testosterone molecule have not been so well documented as have those of similar changes on the biological activity of cortisone; nor have the variations introduced been so numerous. Nevertheless it is possible from a survey of the literature to make certain generalisations.

Essential features

A keto or a hydroxyl group at C_3 and β-hydroxyl group at C_{17} seem to be essential for anabolic activity.

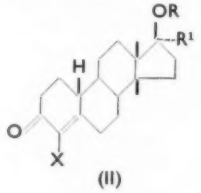
Anabolic enhancement

Analogues of testosterone showing anabolic enhancement have been obtained by the following structural modifications.

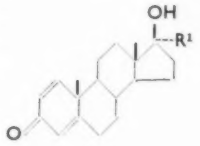
1. The introduction of:
   (*a*) A methyl or ethyl group into the 17α-position.[5,10]
   (*b*) A methyl group into the 2α-position[6] or at C_4.[7,8]
   (*c*) A chlorine or bromine atom at C_4.[5]
   (*d*) A fluorine atom at C_4 or in the 2α- or 9α-positions (the latter together with an 11-keto or 11β-hydroxyl group).[5,9]
2. The removal of the methyl group attached to C_{10} to give 19-*nor*-compounds.[5,10]
3. Dehydrogenation in ring A to give a Δ^1-dehydro-compound (*cf.* prednisone and prednisolone).[3]

Except for the methyl and ethyl groups in the 17α-position, most of these substituents or structural modifications have been introduced singly, but Sala and his co-workers[5] have tested a number of analogues possessing several of these features and have obtained evidence that the effects may be synergistic. It is also clear from the work of Sala that the activity of these compounds is modified by esterification of the 17β-hydroxyl group; in this connection, as will be noted below, cyclopentylpropionates have proved superior to acetates.[5]

Of the compounds in current use, those with the highest anabolic enhancement factors based on rat experiments have been found among the "19-*nor*" and the 1,2-dehydro analogues illustrated below.



(II)



(III)

Compound		Anabolic enchancement factor	Ref.
(II) (*a*)	$R^1 = C_2H_5$; R = H; X = H	17	3
(*b*)	$R^1 = CH_3$; R = CO.CH_3; X = Cl	28	5
(*c*)	$R^1 = CH_3$; R = CO.$(CH_2)_2$–[cyclopentyl]; X = Cl	38	5
(III)	$R^1 = CH_3$	*ca.*100	3

Work in this field progresses rapidly, and further advances, yielding compounds with higher anabolic enhancement factors, can be expected in the future. The progress from synthesis to clinical use is, however, inevitably slow, owing to the extensive pharmacological and clinical investigations needed to establish that, in eliminating some unwanted characteristics, other undesirable side effects have not been introduced.

Œstrogens in animal husbandry

The increase in the use of steroid hormones resulting from the elaboration of economic chemical syntheses for their preparation has not been confined to clinical medicine. The compounds are widely used in the veterinary field, and their effects on the growth of animals reared for meat production have recently been the subject of considerable research.

It is well known that the activity of œstrogens may be assayed by measuring their ability to induce caponisation in cockerels, and it is established that the suppression of the male secondary sex characteristics by these hormones causes the birds to fatten more rapidly. Their flesh is whiter and more tender, and they are regarded with more favour as an article of food.

Diethylstilbœstrol has been used extensively in the United States in poultry rearing for many years, and it was no surprise when in 1954 it was reported that encouraging results had been obtained after its administration to castrated cattle and sheep.[11] Extensive research has been carried out in this field during the past six years, and the use of œstrogens in animal husbandry is now firmly established in the U.S.

The effect of synthetic œstrogens on castrated cattle and sheep is, however, markedly different from that on poultry; more protein and more bone is produced, but less fat is deposited. This results in the leaner cuts of meat that are much favoured today, although the decrease in fat is considered by some to involve a small lowering of quality.

The œstrogens most commonly

used are diethylstilbœstrol and hexœstrol and advantages have been claimed for the co-administration of progesterone or an androgen such as testosterone.[12,13] A preliminary report on a recent trial in this country with a combination of progesterone and œstradiol[14] indicates that this combination may also be more effective than hexœstrol alone; there is clearly much scope for further experimentation on these lines.

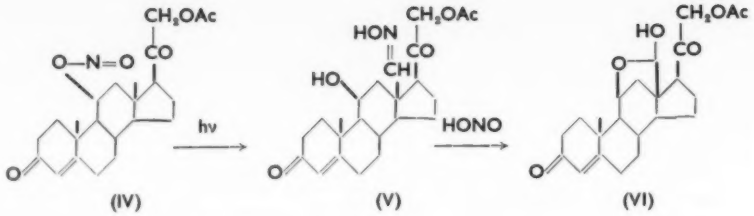
In agricultural practice the hormones may be administered by mixing them with the feeding stuffs or by implanting pellets. The latter method is generally preferred, because it eliminates the possibility of confusion between treated and untreated food and reduces greatly any possible risk to the farm worker. The implants are made at the back of the ear and this part of the animal is destroyed after slaughter. The possibility of the edible meat being contaminated by the implant pellets is thus eliminated; careful studies have shown that the carcasses do not contain significant amounts of the hormones.[15]

The advantages of hormone treatment in the raising of pigs[12] and sheep[16] appear to be doubtful, but cannot be altogether discounted.[17] There is, however, no dispute as to their effect on the growth of beef cattle, whether the animals are being fed on pasture or on growing rations,[12] and in 1958 it was estimated that 70% of all beef cattle on feed in the U.S. were receiving hormone treatment.[12]

Animals treated with hexœstrol grow on average 25% faster than those untreated; over a period of 100 days bullocks will put on an extra 50 to 60 lb. in body weight, the efficiency of the conversion of feeding stuff into meat also being increased by 15-20%.[18] The amount of implanted hormone needed is only 25-100 mg. per animal and this system of husbandry has clear economic advantages.

Some concern has been expressed, however, about the tendency for the treated animals to develop secondary sexual characteristics and about the possibility of the pasturage becoming contaminated owing to elimination of the hormones in the urine and fæces.[19]

Care and discretion are obviously required in the use and further development of these new techniques,[20] but their potential ability to increase world food supplies clearly marks them out as meriting extensive research and evaluation.



Aldosterone—a new method for the synthesis of aldehydes

Extensive investigations into the function of aldosterone in human metabolism have been hampered by scarcity of the hormone, due to the difficulties in its extraction from the adrenal glands and the complications encountered in its synthesis.[21] The position has now been changed completely by a new three-stage synthesis from corticosterone reported at the recent meeting of the American Chemical Society in Cleveland.[22] This novel approach has been made possible by the discovery of Prof. D. H. R. Barton, Dr. M. M. Pechet, Dr. J. M. Beaton and Dr. L. E. Geller that, on irradiation, nitrite esters may undergo an intramolecular rearrangement, resulting in the exchange of the —NO group with a hydrogen atom four carbon atoms distant to form the oxime of a γ-hydroxyketone.

Thus the 11-nitrite ester (IV) of corticosterone acetate, when irradiated in benzene or toluene by a mercury lamp, rearranges to give the oxime of aldosterone acetate (V), which is easily converted into aldosterone acetate (VI) by nitrous acid. Earlier routes to aldosterone have been considerably longer and more complex and the new synthesis has the advantage of producing the naturally occurring stereoisomer. This new reaction gives yields of 30-70% and has been found applicable to aliphatic, alicyclic and heterocyclic compounds, providing that the hydrogen atom to be displaced by the -NO group is conformationally adjacent. Although this requirement slightly restricts its applications, the reaction nevertheless affords an additional and valuable technique; as can be inferred from the example given above, it may be expected to find many applications in the field of synthetic organic chemistry.

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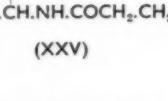
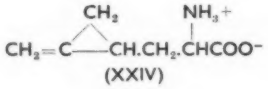
Errata

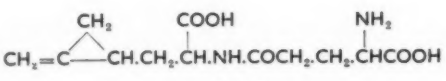
In the previous article of this series (March issue) the structural formulæ depicted for compounds (VIII), (XXIV) and (XXV) were in error and should read:



(VIII)



(XXIV)



(XXV)

▶SHELL FILTER

This type of filter was developed to eliminate the inherent weaknesses of standard filter funnels. It consists of top and bottom shells held together by butterfly clamps which grip the filtering media in position. A boss on the side of the lower plate allows the filter to be mounted on a retort stand and the inlet and outlet can be coupled to normal laboratory glassware with ease. Orthodox or synthetic filter papers and cloths of any weight or porosity can be supplied cut ready for use in discs 6½ in. diameter, a standard size.

The makers—S. H. Johnson and Co. Ltd.—claim that use of this filter avoids atmospheric contamination of deposits and filtrate, and eliminates evaporation losses, since the filter is totally enclosed. Whereas the traditional filter funnel has to be fed manually the shell filter can be fed from an aspirator bottle, or similar device, at a predetermined head and controlled to give a fast rate of filtration.

The most important factor is the use of 100% of the available filtering media, which lies flat on the drainage surface and has no fold creases to impair the efficiency of the media.

The filter is manufactured in aluminium and is finished with a coating of protective phenolic resin. Other models are also available, including one in polished stainless steel.

▶DUST FILTER

The Retroflux bag filter made by W. C. Holmes and Co. Ltd. is designed to deal with high dust burdens and/or adhesive dusts.

Dust-laden air enters the header and is distributed to the inside of the filter bags, the air and dust moving in the same direction. The tendency of the dust to settle by gravity is not impeded by air currents, as the air passes through the filter bags radially and the air velocity gradually drops to zero at their lowest end.

The dust collected on the inner surface of the bags is continuously dislodged by a reciprocating frame of high-velocity air jets through the fabric in the reverse direction to the main air stream. The dust falls to the collecting mechanism below.

In this type of filter the filter bag is continuously cleaned over its entire surface. This means that the filter resistance can be maintained at approximately half of that normally experienced with a conventional bag filter, hence saving power.

S. H. Johnson's shell filter.

▶FIGHTING LIQUID FIRES

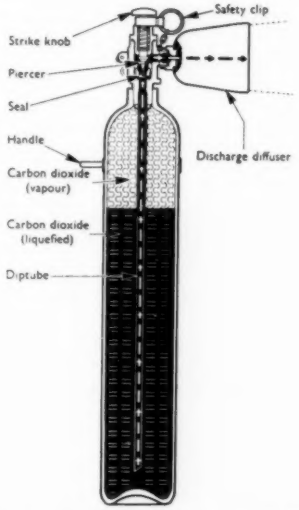
The introduction of a leak-proof, strike-knob, 5 lb. carbon dioxide fire extinguisher, *Model 1505*, is announced by Nu-Swift Ltd. The new model is complementary to the 10 lb. carbon dioxide extinguisher, *Model 1510*.

Mainly intended for fighting inflammable liquid fires, and fires involving electrical equipment indoors, the new extinguisher has a mean range in still air of 11 ft., the carbon dioxide being expelled, for 8 sec. at 65°F., through a novel type of discharge diffuser.

The new model, in the hands of an inexperienced fire fighter, is capable of putting out a 6 sq. ft. inflammable liquid fire. In the case of an experienced fire fighter the corresponding figure is 9 sq. ft.

Carbon dioxide, although much less efficient for fire fighting than dry powder, is non-damaging in use and leaves no residue, while the carbon dioxide can be made to penetrate into places which are inaccessible to other fire-fighting media. Hence it is invaluable for fighting fires in laboratories and operating theatres, or fires involving fine chemicals or complicated electrical or electronic equipment.

Its small weight of 19½ lb. enables the extinguisher to be handled comfortably by women, while it can be reloaded on the spot in 60 seconds by any competent person.



Diagrammatic representation of the new 5 lb. Nu-Swift *Model 1505* carbon dioxide extinguisher.

▶METAL DIPSTICKS

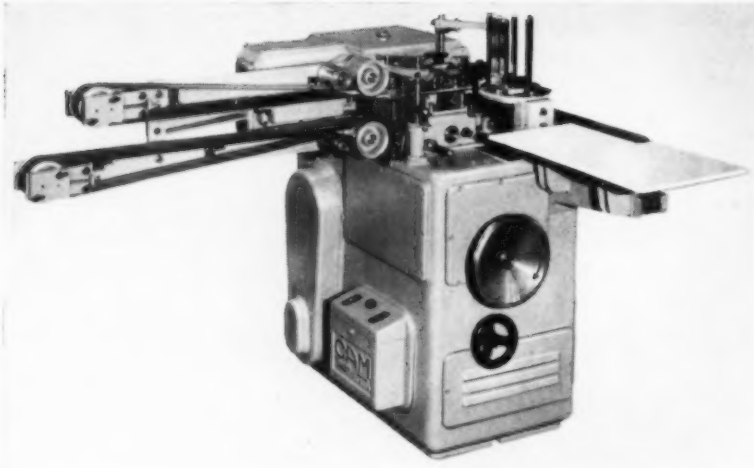
In the past dipsticks have mainly been made of degamé (boxwood), but Dring and Fage Ltd. are now making them in stainless steel and aluminium.

By using a special process to treat the reading face it is claimed that a dip can be taken with these rods without the measured liquid running off the shiny surface.

The rods can be made up to 35 ft. usually inch by inch square and graduated in inches and tenths, or as specially required. One of the advantages of metal dipsticks is that they are more readily sterilised than wooden ones.

▶PUMP OUTPUT DOUBLED

The range of The Distillers Co.'s metering pumps has been further extended by the development of a Duplex version of the "M" pump. By developing from this well-known unit a model which embodies two of the "M" pump's standard pumping heads driven 180° out of phase from a common motor, the output of the pump is doubled and the flow characteristics improved when the heads are operated in parallel. As an alternative



The *Type B* carton erecting, filling, closing and sealing machine made by Construzioni Automatiches Martelli.

application each head can be operated as an independent metering head pumping two different liquids.

The price of the standard duplex pump with totally enclosed motor with separate volume control on each pumping head is approximately £170 and, at the present time, delivery is ex stock.

▶ITALIAN PACKAGING MACHINES

Farrow and Jackson Ltd. have been appointed sole selling agents in Great Britain for the Costruzioni Automatiches Martelli range of cartoning, wrapping and volumetric filling machines.

There are six basic models: the *Type E* is an automatic wrapping and sealing machine for small products in sizes up to $100 \times 60 \times 25$ mm., in materials like film, polythene, foils and other types of plastic film, at speeds of 3,000–6,000/hr. *Type PRI* is an automatic cartoning machine for glass bottles, tablets, toothpaste tubes, etc., where the introduction of a leaflet is necessary. Speeds are from 4,000–6,000 cartons/hr. *Type ER* is an automatic cartoning machine for the packaging of products in which the introduction of a leaflet is not necessary and has speeds up to 6,000 cartons/hr. *Types PNT*, *PNF* and *PNM* cartoning machines are as follows: *PNT* for cartoning toothpaste and cream tubes with V protective card strip secured under the tube cap. *Type PNF* is for packaging of glass bottles with protective corrugated cardboard or paper wrapping, whilst *Type PNM* is for the pharmaceutical industries, packaging more than one article in the same carton, at speeds of 3,500–5,000/hr. *Type PN/3* is for packaging large-size cartons, in sizes up to $110 \times 50 \times 190$ mm. It can also be equipped for paper wrapping.

Speeds are from 2,500–4,000 cartons/hr. Finally, *Type D* is a volumetric filling machine for powders and granular products. It is automatic for box filling and semi-automatic for the filling of paper bags.

Speeds are from 1,000–3,600 fills/hr. Filling volume is from 100–2,000 cu. cm.

▶HUMIDITY CABINET

The model *HTC.2B* humidity test cabinet made by Barlow-Whitney Ltd. is one of their smaller completely self-contained units.

Performance characteristics include: dry heat to 100°C.; wet heat to 70°C.; relative humidities from 40% to 99%; temperature control limits ± 0·5°C.; controlled rapid cyclic temperature variation under damp heat conditions with adjustment for amplitude and frequency.

Circulating equipment ensures even temperature and humidity distribution throughout the working space. Protective devices against water failure and overheating are incorporated.

Other units are available for mould or fungus growth tests and with refrigeration for temperatures down to 0°C., also large tropical chambers with capacities up to 9 feet cube or to special dimensions.

CONTINUOUS FERMENTATION

(*Continued from page* 332)

studied.[15] Coke oven and gasworks effluents are toxic by the fact that they contain (*a*) phenols, (*b*) thiocyanates, cyanides and thiosulphate, and (*c*) ammonia. Groups of microorganisms will oxidise each of these groups of compounds. Because of cross-inhibition of the active organisms the treatment requires to be carried out in a certain order as a three-stage process. Again this type of process has to date only been carried out on a pilot scale.

The National Coal Board has installed experimental treatment plants[16] which have not been as successful as was hoped.

Whilst some of these effluent disposal processes do not fit exactly into the classical definition of continuous culture, they have nevertheless been included in order to demonstrate the diversity of ends to which continuous fermentation is being applied.

From the fact that many of these processes have only reached the pilot plant stage the suggestion can be made that progress is still being hindered, not by any unwillingness on the part of plant operators, but by economic and by technological difficulties.

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Three Centuries of Science

THE ROYAL SOCIETY CELEBRATES ITS TERCENTENARY

NEVER has the Royal Albert Hall provided a more appropriate setting for the Academic Festival Overture, if only because the occasion that Brahms' music was embellishing was perhaps the greatest academic festival of the century—the Tercentenary of the Royal Society. By 2.45 on Tuesday afternoon, July 19, the arena of the Albert Hall was filled with a vast crowd, assembled to witness the ushering in by the Queen of the fourth century of Britain's national academy of science.

The bandsmen and trumpeters of the Royal Military School of Music played Handel, Bach and Brahms as the glittering processions entered the hall, moving slowly down the main aisle to the stage usually occupied by the world's great orchestras. First came the Fellows of the Royal Society, all in academic robes. As they reached the stage, they split into two files and filled the seats on each side; soon the stage was flanked with tiers of gleaming colours—yellow, blue, scarlet, black, green, gold and purple.

Then came the Foreign Members of the Royal Society and official representatives of national academies of science, universities and international scientific organisations. Most wore academic dress that in style and colour brought an exotic magnificence to the scene. Slowly this procession filled the seats immediately in front of the stage from which the Queen was to speak.

Then came the Council and past-Officers of the Royal Society (including three ex-presidents, Dale, Robinson and Adrian) preceded by the famous mace of the Society.

Finally came the Queen, the Duke of Edinburgh, the King and Queen of Sweden and the P.R.S., Sir Cyril Hinshelwood, Professor of Chemistry at Oxford. The Queen wore a flowered hat and a lime green dress; the Duke was in morning dress. After the National Anthem the Queen spoke.

She recalled the founding of the Society under the patronage of Charles II and referred to some of the great Fellows—Newton, Darwin, Watt, Kelvin and Parsons. The Society ordered its affairs today in much the same way as it always had, said the Queen, but an innovation that gave her special pleasure was the admission of women to the Fellowship. After welcoming the foreign visitors she presented the Society with a silver bell to mark her continued interest as Patron and to ring in the fourth century of the Society's history.

Sir Cyril Hinshelwood thanked the Queen and then Sir Arthur Bliss, Master of the Queen's Musick conducted his own work, *Salute to the Royal Society on the occasion of its Tercentenary.*

The pageantry continued with three representative addresses of congratulation given by Professor Graffi representing the University of Bologna, Professor Lecomte representing the Academy of Sciences of France and Sir John Eccles, president of the Australian Academy of Science.

After the President had expressed his thanks for what he called "these precious manifestations of goodwill," he formally introduced King Gustav Adolf VI of Sweden for admission to the Fellowship. The King signed the Charter Book and then, in flawless English, addressed the assembly. He referred to Linnaeus, his own compatriot, who was a Fellow and then to the many Fellows, including the President, who had received Nobel Prizes. The Royal Society, he said, had served as a model for most other national academies of science, not least the Royal Swedish Academy, founded in the eighteenth century.

When the King finished speaking the royal procession left the hall and sat in the royal box to listen to the president's tercentenary address.

For forty minutes Sir Cyril laid what he called an account of the Society's stewardship before the world. In achievement the 300 years of its existence had exceeded all the infinite wastes of evolutionary time; " by the scale of human events they are the fullest and longest in existence."

The men who founded the Society were still fresh in mind and their dedication to the uncovering of the secrets of nature had established a living tradition. Much was said of the sympathy with which the Society's establishment was received but the founders met fierce criticism and even in 1700 the corporate income of the Society was no more than £100. But the original Fellows lived up to the Society's motto *Nullius in Verba*, accepted none of the authority of dogma and remained unmoved by praise or blame.

They were a minority and so was the Society of today —a specialised minor community large enough to command prestige and confidence but with membership confined to those who placed the claims of knowledge first. The principles which should govern such a body were highly important, said Sir Cyril. " An academy is the natural body to provide several vital things, non-commercial periodicals for the publication of discoveries . . . financial support for ideas still too embryonic to be of immediately obvious practical application, the mutual stimulus of association and discussion and the immaterial reward of honour for intellectual achievement."

The Society was no rival to government organisations or to industry and it maintained the closest connections with them by electing into its numbers leaders of both. So it exerted influence far beyond the confines of the learned world.

The President ended his broad and beautifully composed survey with a look at the future. The task of scientists was clear; it was to go ahead undeterred by uncertainities. " Not exemption from danger, hostility or temptation but the power to sustain their impact has made men what they are. The great weapons have been the things of the mind, and among the greatest of these is knowledge.'

" It is the duty of the Royal Society not to predict, not to legislate, but to maintain within the larger community the smaller one in which creative activity can flourish.

Thus began with pomp and pageantry eight days of Tercentenary celebrations. The events included lectures, receptions by universities and the City of London, showings of special films made by the Shell Co., excursions to industrial and university laboratories, a service at St. Paul's Cathedral, a Conversazione at Burlington House and, finally, a banquet—bringing to a close a great festival of science.

W. G. NORRIS.

The Merck Index

Seventh Edn. 1960. *Compiled and published by Merck and Co., Rahway, New Jersey, U.S.A. Distributed in the U.K. by Thos. Morson and Sons, Ponders End, Middx. Pp.* 1641. £5 *net.*

THE Merck Index of chemicals and drugs has been helping chemists for over 70 years and this seventh edition has been revised and enlarged with a thoroughness that will ensure the continued reputation of this book. Though it is only eight years since the previous edition appeared, it has been found necessary to add almost one-third more monographs to make a total of about 10,000 descriptions of chemical entities (not including derivatives), and to enlarge the cross-index of names by more than 50% to reach a total of 30,000. There has been a 50% increase in the number of monographs with structural formulæ to almost 3,400.

A new feature is the separation of the cross-index from the main monograph section to facilitate locating the description of a compound, regardless of the synonym with which the user is familiar. The index is excellent.

There are nearly 250 pages of valuable appendices ranging from organic " name " reactions to poisons first-aid. This edition is a worthy member of a distinguished series of reference works.

World List of Abbreviations

Of Scientific, Technological and Commercial Organisations. 2nd ed. Leonard Hill [Books] Ltd., 9 *Eden Street, London, N.W.*1., 1960. *Pp. x*+300. 25*s. net.*

THIS book is a welcome attempt at diagnosing the literary disease of abbreviations, more particularly the abbreviations formed by the initials of compound names. Often these initials produce words, some neat and euphonious and others ugly and inelegant. Examples of the latter are more easy to find than of the former; for instance, GIDNT (which is the Institute of Technical and Scientific Documentation in Poland) and GIDOTOM (the Group for the Development of Oil Products in the Territories Overseas, in France).

Whether we like them or not, we are going to be increasingly bedevilled by abbreviations and the only way out of the confusion is to consult the list given in this book. It is the revised version of a work first published in 1954 and it now contains about 3,000 abbreviations in strict alphabetical order. After each abbreviation there is a full name and address of the organisation.

Even 3,000 abbreviations do not by any means exhaust the rich profusion which has developed at an almost exponential rate in the last few years. It is impossible to keep completely up to date with them, but this book will prove a faithful guide through an extensive part of the maze. Foreign abbreviations have been freely translated (as in the two examples given above), but owing to transliteration problems Russian abbreviations have not been included.

The book represents a great deal of work, but the publishers modestly disclaim infallibility and welcome notice of omissions for future editions.

Who Owns Whom

Third Edn. Compiled and Published by O. W. Roskill and Co., London, 1960. *Pp.* 438. £6 6*s. net.*

IN THIS new edition this directory of parent, associate and subsidiary companies in industry and commerce appears as a single volume instead of two. There are five main sections: 1. subsidiary and associate companies showing parent and associate companies; 2. parent and associate companies showing subsidiary and associate companies; 3. U.K. companies showing subsidiary and associate companies in the European Common Market; 4. U.K. subsidiary and associate companies showing U.S. parent and associate companies; 5. U.S. parent and associate companies showing U.K. subsidiaries and associates. Sections 3 and 5 are new features.

There are several appendices. One of the most interesting lists the changes in ownership of some U.K. public companies reported in 1959-60. Another lists changes of name of certain public companies since the 1959 edition.

The title exactly expresses the contents. For finding out " who owns whom " the book is unrivalled.

Chem Sources

2*nd ed. Directories Publishing Co., New York. Pp.* 468.

THIS is an excellent guide to chemical sources in the United States. It is easy to believe that it is the most complete guide of its kind. A rapid calculation shows that nearly 19,000 chemicals are listed. The directory published by the Association of British Chemical Manufacturers contains about 11,000 entries in, it must be pointed out, a much more compact format. The heavy paper and large sanserif type throughout makes *Chem Sources* easy to consult, but it is still bulkier than it needs to be.

The layout is simple. The bulk of the book—448 pages—lists the chemicals and their sources. As in the A.B.C.M. list, the sources are shown by numbers. The next section gives the numbers of the companies and the final section lists the companies and their addresses alphabetically.

In spite of its size, the book does not give as much additional information as the A.B.C.M. directory. For instance, the telephone numbers and telegraphic addresses of the suppliers are not given and the valuable list of proprietary and trade names given by the A.B.C.M. is missing.

The nomenclature used is admirably straightforward. Acetic Acid is listed under Acetic Acid and not Acid, Acetic. Salts and compounds are listed under the element name; you find Sodium Benzoate under this name and not as Benzoate of Sodium. Prefixes like alpha, beta, etc., do not affect alphabetical listing. Tert-Butyl Bromide comes under B not T. Conversely, bi, tri, tetra, etc., which indicate the numerical prefix, are treated as part of the chemical listing, so Tetrasodium pyro-Phosphate is found under T. Producers of chemicals are indicated by asterisks.

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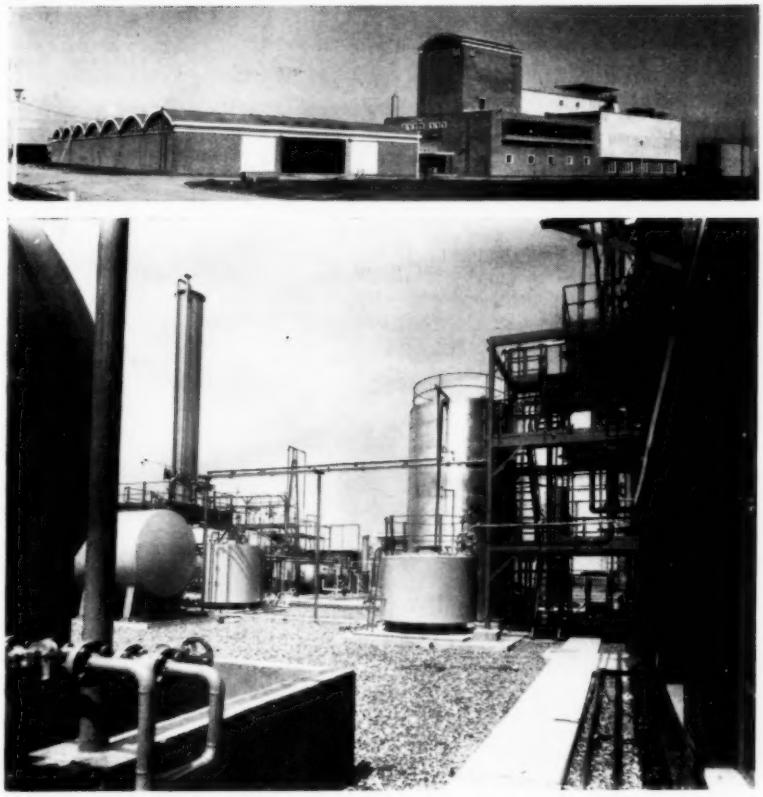
Dow Agrochemicals Start Production in Norfolk



Top: A general view of Dow's factory at King's Lynn. Bottom: Dowpon plant area showing the tankage facilities.

With the completion of their new chemical factory on the estuary of the Great Ouse at King's Lynn, Norfolk, Dow Agrochemicals Ltd. have made considerable price cuts in *Dowpon*, the systemic, selective killer of couch grass and other annual and perennial grass weeds.

The £1 million plant stands on an 80 acre site. It is the first stage in a project planned to become one of the largest agricultural chemical factories in Europe. Its equipment comprises a complete production plant for Dowpon, with all ancillary services. Modern equipment and instrumentation is used and includes corrosion resistant materials such as stainless steel, nickel, glass and plastics. A road and rail system is provided.

Construction began in July 1959, and the plant has now been completed two months ahead of schedule by Constructors John Brown Ltd. to the architectural design of Mr. E. Maxwell Fry, F.R.I.B.A. The Dowpon plant is the British version of the Dow plant in U.S.A. The design has been supervised by Mr. J. W. Warbourg, chief engineer to Dow Agrochemicals Ltd.

Dowpon has previously been imported and borne a heavy duty. With the commencement of production at King's Lynn prices have been cut. These amount to nearly 20% all over, but are graduated according to quantity purchased. A single 50-lb. drum retails now at 9s. 9d. lb. instead of 11s. 9d., while for purchases of 15 such drums and over, the price drops to 8s. 9d. lb. On the farm scale the cost of stubble spraying drops from £5 17s. 6d. to £4 7s. 6d. an acre, while barrier spraying will now cost £2 12s. 6d. per 1,000 yards instead of £3 10s. 6d.

Dowpon has been proved to be a clean, fast and modern way of controlling reeds and reedmace in farm drainage ditches and watercourses, where up to now cutting by scythe has been used. By this new method reeds can be completely destroyed for under 2s. a chain both sides of a 6 ft. wide farm drain, whereas hand cutting (which needs repeating every year and sometimes twice a year) costs 8s. for a single cut and 14s. to 20s. for two cuts.

Dow Agrochemicals Ltd., also handle *Etrolene*, *Zoamix* and *Nankor*, the new non-toxic fly killer. All these products will in the near future be manufactured at the King's Lynn factory.

Industry's Publications

Mechanical handling equipment. The latest catalogue from J. Collis and Sons Ltd. describes the SlatVeyor, an endless slat conveyor designed to handle loads unsuited to belt or roller conveying, and the LoadaVeyor, a mobile conveyor either of the four-wheel or two-wheel chassis type.

Wetting agents. Allied Colloids (Mfg.) Co. Ltd. have produced a brochure dealing with their wetting agents *Alcopol O* and *ON* which are based on sodium dioctylsulphosuccinate and sodium dinonylsulphosuccinate respectively. In it are described the physical and chemical properties, and applications of these compounds.

Export publicity. A new edition of the Government's "Export Promotion Leaflets" published by the Central Office of Information explains how industry can co-operate in Britain's overseas publicity. Presented in an attractive folder, the eight leaflets give a general introduction and cover the Overseas Press, Photographs, Film, Publications, Reference and Tours and Facilities Services, as well as the planned distribution of commercial and industrial publicity material. It is hoped that this publication will promote greater partnership between the Government and industry and thereby project British potential to overseas customers. Copies may be obtained free from the Controller (Overseas), Central Office of Information, Hercules Road, London, S.E.1.

Same name, new formula—"Swindle," says M.P.

Mr. Derek Walker-Smith, Minister of Health, whose resignation was announced on July 22, said in the Commons that he had arranged with the Association of British Pharmaceutical Industry for a temporary extension until December 16 of the voluntary price regulation scheme for proprietary drugs.

This would allow further time for the review which he and the Secretary of State for Scotland were making of the experience gained during the trial period of the scheme before arrangements for the future were settled.

* * *

The Chairman of the Advertising Enquiry Committee, it was stated, had been told by the Minister of Health that he had no power to control the naming or advertisement of medicinal preparations, but that he understood the Working Party on the law relating to medicinal substances were to review statutory restrictions on their advertisement.

Mr. Dennis Vosper, Parliamentary Secretary to the Ministry, said this when Mr. Francis Noel-Baker (Labour, Swindon) questioned him about representations from the committee chairman on the sale of certain proprietary drugs, whose formulæ had been changed since the introduction of recent regulations, although the original brand had been retained and in some cases similar claims continued to be made by the makers.

Mr. Vosper said that the chairman had asked for the Minister's comments on the situation.

Mr. Noel-Baker suggested that it would be a good thing if, arising from the work of the Working Party, power was taken. "Swindles are being perpetrated on the public on a considerable scale," he alleged. "One firm which makes a drug which may now not be sold without a prescription, has produced a new formula and is marketing it under the same name. There are other instances. Is it not time to take steps to protect the public from frauds of this kind being perpetrated?"

The Parliamentary Secretary replied that he had seen the advertisement concerned. "There may well be something in what Mr. Noel-Baker says," he added. "It is not a matter for the Poisons Board, but it may well be within the jurisdiction of the Working Party to which he has referred."

Toxic lipstick colours

An important move disclosed last month was that the Home Secretary, Mr. R. A. Butler, had decided to ask the Poisons Board whether it wished to make recommendations to him about certain lipstick colours.

This was stated when Mrs. Joyce Butler (Labour, Wood Green) requested that the Board should be asked to examine the 17 lipstick colours it was proposed to remove from the "harmless" list in the United States. Mrs. Butler, who sent the Home Secretary details of the lipsticks, called for guidance to be given to the cosmetics industry in this country.

When referring it to the Poisons Board, the M.P. added, would Mr. Butler ask them to consider examining what quantities, if any, of these colours could be absorbed safely into the digestive systems of women using lipstick?

Mr. Vosper, who answered the question, said he understood that the view that these dyes had a carcinogenic effect was not accepted. He was sure, however, that the matter would come to the Board's attention.

Oral polio vaccine

A decision as to the use of oral vaccine in Britain's anti-polio vaccination programme is unlikely to be reached for some time yet. It will depend on the outcome of small scale trials of the Sabin oral vaccine being carried out by the Medical Research Council and on experience gained in other countries, said the Health Minister.

He denied that the Government were moving rather slowly in view of the fact that over 10 million people in the world had now been subjected to trials with this type of vaccine. Experience in other countries, said the Minister, was not necessarily applicable to conditions in Britain.

DDT ban refused

Mr. John Hare, Minister of Agriculture, Fisheries and Food, does not intend to restrict the use of DDT.

Dr. Barnett Stross (Labour, Stoke-on-Trent, C.) had suggested that steps should be taken to prevent the indiscriminate use of DDT pesticide by farmers and market gardeners. He said it was easily absorbed by human tissue following the eating of foodstuffs contaminated by it, and it tended to remain permanently in the body.

Mr. Hare replied that DDT eaten by a mammal might be stored in its fat, but not in any other of its tissues. It slowly disappeared from the fat when intake ceased. Although DDT had a very wide range of use he had no reason to think that it was used indiscriminately.

Deceptive packs

The President of the Board of Trade, Mr. Reginald Maudling, stated that he was considering the inclusion of proposals about the marking of soap and detergent containers with the amount of the contents, in the new Weights and Measures Bill.

The Bill, he told M.P.s, was nearly ready and he hoped it would be introduced in the next session. Mr. Francis Noel-Baker said that modern sale design techniques made it very easy to produce extremely misleading packages.

New swine vaccine needed

Sir Leslie Plummer (Labour, Deptford) asked about the incidence of outbreaks recently among pigs vaccinated with crystal violet vaccine.

Research was going on into the difficult problem of finding a vaccine to immunise cattle against Johne's Disease which did not give a false tuberculin test reaction, Mr. Hare said. He could not say when it was likely to yield positive results.

Mr. Hare also informed Members that the Agricultural Research Council was reviewing the dangers to human or animal health of feeding synthetic œstrogens and antibiotics to livestock.

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(*Continued from page* 349)

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Doubts on gamma ray sterilisation of drugs

A.B.P.I. report puts cost at 3½d. per lb.

WHILE gamma rays can effectively sterilise pharmaceutical products radiation causes changes which might make preparations unacceptable. The cost of gamma sterilisation is about 3½d. per lb. on a throughput of 2·4 million lb. p.a., but this cost will rise for the smaller throughputs common in the pharmaceutical industry so that economically the process would be limited.

These are the main conclusions of a working party set up in 1956 by the Association of British Pharmaceutical Industry which, in collaboration with the School of Pharmacy, University of London and the Isotope Division of the Atomic Energy Research Establishment, has been studying gamma ray sterilisation. The A.E.R.E. processed a wide range of pharmaceuticals and biologicals, using cobalt-60 as the radiation source.

Gram-negative organisms are more susceptible than Gram-positive organisms; spore-bearing organisms such as *B. subtilis* and *B. megatherium* are most resistant. But a dose of 2·5 million rad achieved sterility in almost every instance. But this dose changed the colour of many drugs (*e.g.* morphine sulphate from white to mustard yellow and progesterone from pale cream to bright yellow) and affected the potency of others (*e.g.* insulin injection was almost completely inactivated).

Radiation also caused neutral glass containers to go brown and this could affect the presentation of a product if irradiated in its final container. The contents and its physical state (powder or solution) influenced the degree of container colour change.

The costs were based on an installation costing £100,000 (half for radiation sources and half for plant) the operating costs of which were estimated at £35,750 p.a. On a throughput of 2·4 million lb. p.a. (large for the pharmaceutical industry) the unit cost would be 3½d. per lb.

While the report doubts the feasibility of a single firm being able to instal an irradiation plant it points out that smaller quantities could be treated by outside firms with radiation facilities.

Other practical uses for radiation might be control of contamination during manufacture or the sterilisation of containers.

The report details the effects of radiation at 2·5 million rad on antibiotics, alkaloids, procaine hydrochloride, progesterone, talc, organo-metallic compounds, sulphonamides, sugars, barbiturates, biologicals, ascorbic acid, octyl gallate and soft paraffin.

The working party has now been wound up and individual companies are advised to follow up the findings as they think fit.

B.H.C.'s new plant on stream

The third ethylene plant at Grangemouth, Scotland, of British Hydrocarbon Chemicals Ltd., has been completed ahead of schedule and the plant is already on stream. It is believed to be the largest of its kind outside the U.S.A. and will double the existing capacity of B.H.C.'s two previous ethylene plants, which were first operated in 1951 and 1956 respectively.

Smiths Industrial Division

S. Smith and Sons (England) Ltd. has formed a new division to integrate its business in industrial products, which have hitherto been made or marketed by the following subsidiaries: Smiths Industrial Instruments Ltd., Kelvin and Hughes (Industrial) Ltd., David Harcourt Ltd.

General manager of the new Smiths Industrial division is Mr. W. M. Cann who has been general manager of Smiths Industrial Instruments Ltd. since 1955.

The head office of the new division is Chronos Works, North Circular Road, London, N.W.2.

Fire at Grangemouth plant

On the night of July 6/7 there was a small fire at Union Carbide's polyethylene plant at Grangemouth, Scotland. Gas discharged from a safety-valve ignited. This was brought under control and extinguished by the CO_2 system installed in the plant. Local fire brigades promptly rendered assistance. No employees were evacuated, there were no casualties and there was no damage to equipment. The plant was back to normal in 3 hr.

£1 million to enlarge fertiliser factory

A £1 million extension to Fison's fertiliser factory at Immingham, Lincolnshire, will enable the production of phosphoric acid to be stepped up from June 1961. Ammonium phosphate will also be manufactured for the first time following modifications to a plant now producing triple superphosphate. It will be distributed to Fisons fertiliser plants throughout Britain, where it will be used in the manufacture of high analysis compounds.

In addition quayside operations will be speeded up at Immingham and the rate of turn-round of shipping increased by the installation of additional cranage and modifications to the raw material intake system. Storage for phosphate rock will also be increased.

These developments follow little more than a year after the opening of Fisons' ammonium nitrate factory on the Thames Estuary at Stanford-le-Hope, which was built as part of a £4½ million scheme.

New office for a Laporte company

James Wilkinson and Son Ltd., Sheffield, a member of the Laporte Group is now operating a Midlands Area Office. The office is at 153 Parker Drive, Leicester (telephone: Leicester 63861), which is also the Midlands Area office of other companies in the Laporte Group.

Additional products which will now be obtainable from Leicester include hydrofluoric acid, fluorine chemicals, analytical reagent acids and commercial acids.

Pesticides rules

A new booklet has been prepared by the Association of British Manufacturers of Agricultural Chemicals which brings up to date the provisions of the Pharmacy and Poisons Act 1933 and the Poisons Rules 1960 relating to the sales of insecticides, fungicides, weedkillers and rodenticides.

The booklet replaces the chart formerly issued by the Association and will be of interest to anyone selling pesticides.

Copies of the booklet (price 3s.) may be obtained from the Association, Cecil Chambers, 86 Strand, London, W.C.2.

Food antioxidants under review

The Government is to review the Antioxidant in Food Regulations, 1958, and the Antioxidant in Food (Scotland) Regulations, 1958. The main points which will be considered are the antioxidants to be permitted, the foods in which they may be used, the maximum allowance for permitted antioxidants, and labelling requirements.

Before deciding whether, and to what extent, amendments to the regulations are necessary, the Government will give consideration to any representations made by interests concerned. These should be addressed to the assistant secretary, Food Standards Division, Ministry of Agriculture, Fisheries and Food, Great Westminster House, Horseferry Road, London, S.W.1, or to the Secretary, Department of Health for Scotland, St. Andrew's House, Edinburgh 1, to arrive not later than December 31, 1960.

Beecham's to spend £1·5 million on antibiotics

With sales of almost £50 million the Beecham Group Ltd. again increased their trading profits. Mr. H. G. Lazell, the chairman, in his annual report said that profits had risen by £1,102,146 to £7,843,367. Total sales amounted to £49,959,000 (£40,408,000) with expansion in both the home and overseas markets.

The pharmaceutical division is now concentrating on new antibiotics, notably *Broxil*, the first synthetic penicillin, introduced into the U.K. in October 1959. Much has been done since the discovery was made. Beecham Research Laboratories Ltd. has been expanded to cover all aspects of research, manufacture, packaging and marketing and also the research station at Brockham Park, Surrey, has been extended by one-third.

New factory. The construction of an antibiotic factory at Worthing began last December and production is due to start at the end of this year. The factory will also produce chemical side chains of the penicillin nucleus and fine chemicals for use by the group.

Broxil is now available in Canada and will also be sold in some European markets. Licensing agreements are being arranged in other overseas territories for the manufacture of the new antibiotics.

So far the group has approved £1·5 million for antibiotic development. This will include expansion at Brockham Park, where current expenditure is £600,000 p.a., which is expected to rise at £100,000 every year.

Transatlantic link for vets in Congress

The British Small Animal Veterinary Association plan to hold their Fourth Annual Congress in London from April 20 to 23, 1961. The choice of date is designed to coincide with a meeting of the American Animal Hospital Association in the United States. This is to permit a transatlantic discussion between American and British veterinarians during the congress. This transatlantic telephone link, lasting for one hour, will allow simultaneous discussion on both sides of the Atlantic. This will be the first such link at a veterinary conference, and the organisers are indebted to Smith Kline and French Laboratories who are providing this facility.

As the date of this conference falls between the International Veterinary Congress in Madrid and the forthcoming one in Hanover, it has also been decided to make this an occasion for a European small animal meeting. Invitations will be sent to all national small animal groups in Europe, and overseas speakers will be invited to present papers. The Congress venue has been moved this year to the Kensington Palace Hotel.

Enquiries can be made to the Hon. Secretary, B.S.A.V.A., Mr. G. N. Henderson, B.SC., M.R.C.V.S., at Broadway House, The Broadway, London. S.W.19.

Colour TV illustrates cancer research

Ciba's novel *Eidophor* system of colour television, which was developed in Switzerland, was used to illustrate a lecture on "Cell, Chromosome and Virus Microscopy in Cancer Research" at the Royal College of Surgeons on May 10. The lecture, given over a closed circuit, featured such eminent cancer researchers as Prof. A. Haddow, director of the Chester Beatty Research Institute, Prof. G. J. Cunningham, Professor of Pathology, R.C.S., Prof. P. C. Koller, of the Chester Beatty Research Institute, and Dr. R. J. C. Harris, of the Imperial Cancer Research Fund.

The advantage of the *Eidophor* system is that the picture may be projected on to a large screen, since the projector does not rely on electronic means for producing the light, but controls the light from an external source provided by a 2kW arc lamp by electronic means. Thus there is no real limit to the size of the picture that may be obtained. The *Eidophor* projector can be used for projecting black and white pictures from a normal public TV broadcasting system, though at present it can only be used on a closed circuit system for colour projection.

Ciba have made six prototype projectors and plan a production line of 100. The equipment costs £7,500 in Switzerland, with 20% extra for colour reproduction.

Wood Preservation Ltd. join British Ratin Group

Wood Preservation Ltd., London, has been bought by the British Ratin Co. Ltd., Sussex, the pest control company.

Wood Preservation Ltd. are the sole agents in the U.K. for the wood preserving products manufactured by Desowag-Chemie G.m.b.H. of Germany. These products include the Xylamon range for the preservation of timber against infestations by wood boring insects and attacks by wood-rotting fungi; Pyromors, a fire-retardent paint; and Xylacolor, a pore-filling wood preservative.

The company will continue to operate from 142 Sloane Street, London, S.W.1.

Pest control films for loan

The Industrial Pest Control Association has compiled a list of members' films which are available on loan. The films depict some aspects of the use of insecticides and rodenticides for control of pests causing disease damaging timber and foodstuffs in store. Requests to borrow the films should be made to Industrial Pest Control Association, Cecil Chambers, 86 Strand, London, W.C.2.

Oxygen equipment for new hospital

Altnagelvin Hospital near Londonderry, Northern Ireland — officially opened by Lord Wakehurst, Governor of Northern Ireland—is provided with the latest oxygen and anæsthetic equipment.

Two miles of pipelines, supplied by the medical division of British Oxygen Gases Ltd., distribute oxygen, nitrous oxide, compressed air and vacuum to more than 210 points. Of these 115 are oxygen, 34 nitrous oxide and 60 vacuum points, the remainder being compressed air.

Cosmetic grade of hexylene glycol

The Distillers Co. Ltd. have introduced a specially refined grade of hexylene glycol for the cosmetic trade. The material will be known as *Bisomel* grade hexylene glycol and should not be confused with *Bisol* hexylene glycol, a grade produced for industrial purposes.

Symposium on powders

Sir Alexander Fleck is to be president of honour of the symposium on "Powders in Industry: Properties and Principles of Application" to be held on September 29-30, 1960, at the Royal Institution, London. He will also open the symposium which is being organised by the Surface Activity Group of the Society of Chemical Industry. The purpose is to bring together scientific and technological representatives of the many industries in which fine powders are important, whether as raw material, an intermediate processing stage, or final product, and provide opportunity for discussing problems in diverse industrial fields. There will be 30 papers from foreign and British scientists. Pre-prints of all papers will be circulated to the participants before the opening of the symposium. A registration form and programme of the symposium may be obtained from the Hon. Secretary of the Surface Activity Group, The Society of Chemical Industry, 14 Belgrave Square, London, S.W.1.

Microscope maker bought out

Griffin and George Ltd. have purchased the whole share capital of R. and J. Beck Ltd. optical instrument manufacturers.

R. and J. Beck Ltd. operate two works, at Watford and Kentish Town, and have offices and a showroom at Mortimer Street, London, W.1. The total staff employed is over 200 people.

Griffin and George will retain Beck's as a separate entity. The name will remain unchanged.

Beck's manufactured the new 3-D image microscope, designed by a team led by Mr. Richard Gregory, at the Cambridge University Psychological Laboratory. The microscope is proving useful in the examination of living cells and thick sections of suitably strained brain tissue to see how the brain cells are related to each other.

Sir Alexander Fleck honoured

A link with the past, forged in the days when he was intimately associated with the Cassel Cyanide Co. (whose headquarters were in Glasgow), was recalled at a recent ceremony in London, when Sir Alexander Fleck, F.R.S., was presented with a gold medal by the Degussa Co. chemical and non-ferrous metal manufacturers, of Frankfurt am Main.

The Cassel Cyanide Co. (later incorporated in I.C.I.) was at one time a strong competitor of the Degussa Co. for the cyanide market, particularly in South Africa.

The presentation was made by Dr. Felix Prentzel, president of the Degussa organisation, in the presence of Mr. Ungerer, a director of Degussa, and Dr. J. Ferguson and Mr. G. K. Hampshire, directors of I.C.I.

Sir Alexander Fleck receives a gold medal from the Degussa Co. The group shows (left to right) Mr. G. K. Hampshire, Sir Alexander Fleck, Dr. John Ferguson, Dr. F. Prentzel and Mr. Ungerer.

Dr. Robert Galley, Director of the Tropical Products Institute in the U.K. since 1953, has now succeeded Dr. J. E. Hardy as manager and director of research of the Woodstock Agricultural Research Centre of Shell Research Ltd., near Sittingbourne, Kent.

A member of the World Health Organisation Expert Panel on pesticides since 1949, Dr. Galley has been chairman of the W.H.O. Expert Committee on pesticides on four occasions. He has also acted as a W.H.O. consultant at their headquarters in Geneva and Yugoslavia.

Thomas W. Rayner, chairman and managing director of Merck Sharp and Dohme Ltd. has retired. The company which was later to be Merck Sharp and Dohme Ltd. was formed by Mr. Rayner in 1928. Just recently new pharmaceutical laboratories were completed at Hoddesdon. In 1957 the old-established house of Thomas Morson and Son Ltd. became a part of the M.S.D. organisation.

Mr. Rayner has been active in the affairs of the Association of British Pharmaceutical Industry for a number of years. He expects to settle down in Montreal, Canada, where he will act as a business consultant.

R. R. Walker has been appointed to the group board of Aspro-Nicholas Ltd. Mr. Walker, formerly an associate director of the company, has taken up a new post, that of group staff marketing manager. He will remain as a director on the boards of Ivers Lee Ltd. and Askit Ltd., two subsidiaries of Aspro-Nicholas Ltd.

Other appointments announced are those of **R. Rigby** to the post of general manager of the new Home Division and **W. G. Dorkings** to a new position as controller of manufacturing.

J. D. Page has been appointed market department manager of Carnegies of Welwyn Ltd. He took up his appointment on July 1.

C. R. Prichard, the director in charge of I.C.I.'s Heavy Chemicals Group has resigned because of ill-health. He joined Brunner, Mond and Co. Ltd. in 1926 as a chemist and, after serving in various executive capacities in the Alkali and Salt Divisions, was appointed a director of the company in 1952.

Dr. G. D. Rosen has been appointed general manager of International Protein Products Ltd., a subsidiary of British Glues and Chemicals Ltd., formed to develop the manufacture and sale on a world-wide basis of protein isolates produced from vegetable sources by the Chayen process.

Following the sudden death of **W. Dunbar Ferns,** who had represented the Kestner group of chemical engineers in Scotland for the last 15 years, Kestner announce that his son, **A. W. Dunbar Ferns,** has joined their staff as technical sales engineer and will represent the Kestner interests in Scotland.

F. A. Lyne, hon. secretary of the Association of Public Analysts, has joined the consulting practice of J. A. Radley as head of the Analytical Section, but has retained his appointments as Public Analyst and Official Agricultural Analyst. His new address is Radley Industrial Research and Development Laboratories, 27 Elgar Road, Reading.

Edward Reeve Angel has been appointed a non-executive director of Albright and Wilson Ltd. He is chairman and managing director of Star Paper Mills Ltd. and a director of other companies.

Hickson and Welch (Holdings) Ltd. have appointed **Dr. T. Harrington** to the post of vice-chairman. He will continue as joint managing director of Hickson and Welch Ltd. together with his co-director, G. K. Day.

Obituary

The Distillers Co. Ltd., regret to announce that **J. M. Rimington,** managing director of their Chemical Division until April 1, 1960, died after a long illness in the London Hospital.

Mr. Rimington was one of the original employees of British Industrial Solvents Ltd., the first large-scale D.C.L. chemical venture, from the time of its formation in 1929. He was thus closely associated with the practical development of D.C.L. in the industrial chemical field from the beginning.

Promotion came within B.I.S.—to company secretary in 1939, to the board in 1945, and to managing director in 1953. Four years later, on the formation of the Chemical Division, which comprised the Industrial Alcohol Department, B.I.S. and the Carbon Dioxide Co. he was appointed division managing director. He was also on the board of five companies associated with the Chemical Division, and of these he was chairman of three—Orobis Ltd., Hedon Chemicals Ltd. and Honeywill-Atlas Ltd.

Fisons Horticulture Ltd. have made two new appointments. **F. J. Heath**, general manager, will fill the newly-created position of managing director, and **K. J. S. Vasey,** now deputy general manager, is appointed general manager.

Mr. Heath, aged 45, joined the Fison Group in 1955 as manager of the Horticultural Sales Department. Mr. Vasey, also 45, joined Fisons in 1955 with special overseas responsibilities.

D. A. Hubbard, has been appointed to the board of CIBA Laboratories Ltd. He is in charge of production at CIBA (A.R.L.) Ltd., Duxford, Cambridge, and following the resignation of **Dr. N. A. De Bruyne** from the position of managing director of CIBA (A.R.L.) Ltd., Mr. Hubbard will become joint managing director with **R. F. G. Lee.** Mr. Hubbard was educated in Cambridge and subsequently in the School of Pharmacy at Nottingham University.

F. J. Heath

D. A. Hubbard

He joined Aero Research Ltd., as CIBA (A.R.L.) Ltd. was then called, as works manager in 1939 and became a director of the company in 1958. Throughout this period he was mainly responsible for the planning of new ureaformaldehyde and epoxy resin factories, as well as other post-war building developments at Duxford.

Dr. Harry Hookway, 38, assistant director of the National Chemical Laboratory, has been appointed director of the U.K. Scientific Mission in Washington, D.C., and scientific attaché at the British Embassy there. He will succeed **E. S. Hiscocks,** who is returning to Britain in the autumn on completion of a three-year tour of duty to become director of the Tropical Products Institute.

J. A. Harvey has resigned as general sales manager (Bisol) of the Chemical Division of The Distillers Company Ltd. and **R. M. F. Fenning** (formerly marketing manager) has been appointed in his place. **A. A. Puddick,** export sales manager, has been appointed marketing manager, and **J. Tedd** succeeds Mr. Puddick.

Dr. S. Z. Ileri, PH.D., M.SC., virologist, has joined the staff of Evans Medical Ltd., Speke, Liverpool.

Neoprene in Northern Ireland

The first commercial production of neoprene synthetic rubber in the U.K. has started at Du Pont's Maydown works, Northern Ireland.

The works is owned and operated by the Du Pont Co. (United Kingdom) Ltd., a wholly owned subsidiary of E. I. du Pont de Nemours and Co. of Wilmington, Delaware, U.S.A. It is located on a 365-acre site at Maydown, near Londonderry on Lough Foyle, and is designed to produce the various types of neoprene synthetic rubber and neoprene latex in greatest demand for a variety of end-products. About 400 men and women, most of whom come from Northern Ireland, are employed.

The Maydown works consist of four major production areas, including facilities for the manufacture of nitrogen, hydrogen, hydrogen chloride and other chemicals necessary for the polymerisation process. There are eight main buildings comprising an administration building, canteen, engineering shops, stores, change house, medical centre and a quality control laboratory.

Maydown works is equipped with the latest type of machinery, 95% of which was purchased in the U.K., the rest in Western Europe and the U.S.

The building of the works began in January 1958, and at the peak period of construction about 1,200 people were employed. The major part of the construction personnel was recruited locally. Design and engineering consultation was furnished by the parent company.

Thiophenols agency

C. Tennant, Sons and Co. Ltd., of 4 Copthall Avenue, London, E.C.2, in conjunction with Fallek Chemical Corp., New York, have taken over the sales and distribution in the U.K. for the Pitt-Consol Chemical Co., New Jersey, of their thiol products and tar acids.

Some of the aryl mercaptans are now available in commercial quantities, in particular thiophenol, thiocresol (mixed isomers) and thioxylenols (mixed isomers). Pitt-Consol Co. have also issued a booklet entitled "The Chemistry and End Uses of Thiophenols" in which they indicate the many applications in which these products could feature.

Additionally Pitt-Consol are examining several new derivatives with a view to producing them on a commercial scale. These include monomethyldiithiohydroquinone and S-methylthiophenol (Thioanisol) in addition to other products.

C. Tennant will supply the booklet on request, and also submit samples.

Price cutters in court

Byrite stores of London, N. 1, who had been undercutting the price of Johnson's baby powder, were proceeded against by Johnson and Johnson in the High Court. The manufacturers obtained an injunction restraining Byrite from undercutting the price of their goods and got 75 guineas costs. The case is a reminder of manufacturers' rights under section 25 of the Restrictive Trade Practices Act, 1956.

Corrosion school

Battersea College of Technology will be holding their 7th Summer School on Corrosion, "Protection of Metals by Paints," on September 26-28.

This course of nine lectures will deal with protection of metals by paints, with particular emphasis on recent developments in this field. The lectures, which will be given by authorities in their particular field, will deal with pretreatment; phosphating; mechanism of protection; paint formulation; paints for industrial, atmospheric and marine application; coatings for protection of metals underground; lacquers.

Ample opportunity will be given for questions and discussion.

Fee for the course: £10 10s. (inclusive of luncheon, morning and afternoon refreshment).

Early application is advised. Enrolment forms should be obtained from The Secretary (Summer School), Battersea College of Technology, London, S.W.11.

Aerosols symposium

A symposium on the physical chemistry of aerosols will be held at the University of Bristol under the auspices of the Faraday Society on September 13-15. The chairman is Sir Harry Melville.

There will be 24 papers, including four from the U.S.S.R., seven from the U.S. and one from Australia. Applications to attend should go to the Faraday Society, 6 Grays Inn Square, London, W.C.1.

Aerosol journal

Durazone-Choice Products have published a house journal, "Aerosol World." It covers the aerosol pressure-pack trade and is intended as an information service between manufacturer and distributor.

It is available free to the wholesale and retail trade from Durazone-Choice Products, Ballards Lane, London, N.3.

New Offices for Whiffens

Whiffen and Sons Ltd., have opened a new block of offices occupying 10,000 sq. ft., as an extension of Willows Works, at Grange Street, Loughborough. The opening ceremony was performed by Mrs. A. Robinson, wife of the managing director.

The new offices will free factory space which will be devoted to extending productive capacity. Equipment is already being installed.

Anusol hydrocortisone ointment

William R. Warner and Co. Ltd., have introduced *Anusol* ointment. This new formulation is based upon the original ointment with the addition of 0·25% hydrocortisone acetate. The ointment is designed for the rapid relief of pruritus and inflammation of the perineal area.

It is packed in 10 g. tubes and the trade price is 90s. per dozen tubes.

Denaturant

A new synthetic bitter substance called *Bitrex* has been introduced by T. and H. Smith Ltd., Blandfield Works, Edinburgh. It is available as an aqueous solution. One-eighth fl. oz. added to 1 gal. gives a concentration of 1 in 500,000 (0·0002%), which is the stength suggested as a partial denaturant. *Bitrex* solution is packed in polythene bottles each containing 40 fl. oz.

Aureomycin veterinary products

Cyanamid of Great Britain Ltd. are marketing three new veterinary products. They are

Aureomycin powder 2% (containing 1% benzocaine) in a 15 g. plastic puffer, which is for use in the prevention and treatment of bacterial infections of wounds.

Aureomycin ointment 3% in ½ oz. tubes, general wound dressing ointment for topical application; and

Aureomycin ophthalmic ointment 1% in ⅛ oz. tubes, now being marketed for the first time in a veterinary pack.

Antihistamine

A new preparation of *Nilergex* which is additional to the oral forms already available has been introduced by I.C.I. Pharmaceuticals. It is intended for use where parenteral antihistamine therapy is indicated. Doses up to 1 ml. should be given by intramuscular or intravenous routes. When given intravenously the injection should be carried out slowly over a period of 20 sec. Subsequent treatment should be with oral tablets unless there are special reasons for continuing parenteral *Nilergex*. 1 ml. ampoules contain 10 mg. per ml. of isothipendyl hydrochloride. In packs of 5, they retail at 4s. each.

P.C.C. for paper coating

A new grade of precipitated calcium carbonate, intended primarily for paper coating where good opacity is required, has been introduced by John and E. Sturge Ltd. under the trade name *Calopake PC*.

This is a fine calcite which is claimed to give paper an excellent surface finish, greatly improved whiteness and ink receptivity. Being a powder, *Calopake PC* is easier to transport, store and handle than the *Calofort U* paste which it largely supersedes.

Skin treatment

William R. Warner and Co. Ltd., Eastleigh, Hampshire, are now producing *Ecomytrin* cream with hydrocortisone. It is designed for the treatment of infected skin lesions where inflammation is a problem. Packs and trade prices are 72s. per dozen 5 g. tubes and 16s. 6d. each 15 g. tube exempt P.T.

Hypnotic

Following pharmacological work and clinical trials carried out here and in America, Persomnia Ltd. Slough, have introduced a completely new formula for *Persomnia*.

In the largest hospital trial 1 to 4 tablets of a quite novel formula was given to 157 subjects with insomnia not due to pain or other physical discomfort. Each tablet contained 250 mg. salicylamide and 100 mg. phenacetin. Satisfactory sleep was obtained in 77% of patients. There were "few side reactions" and "no evidence of habituation."

Pharmacological work has demonstrated that a 2½ : 1 salicylamide-phenacetin combination had the most marked hypnotic effect of a large number of similar combinations that were tested. This effect is distinct from the analgesic action of the constituents and appears to be due to a potentiation of phenacetin of the mild sedative qualities of salicylamide.

Persomnia contains 375 mg. salicylamide and 150 mg. phenacetin. The packs have been redesigned in blue and white, and the retail selling price has been reduced to 2s. 6d. (small) and 5s. (large) in the special "Kidi-pruf" container.

Fungicides and bactericides

Two new fungicidal and bactericidal agents, *Loramine U.185* and *Loramine DU.185*, for use in soaps, detergents, cosmetics and pharmaceuticals have been developed by Dutton and Reinisch Ltd. They are claimed to overcome the disadvantages of other effective bactericides which are toxic in varying degrees and tend to be harsh on the skin. The two new products, undecylenic acid monoalkylolamide and dialkylolamide, are claimed to be low in toxicity, mild to the skin and easy to apply and to formulate.

Loramine U.185 is a waxy material which can be supplied as a powder for incorporating into powders or creams. *Loramine DU.185* is a water-soluble liquid for use in liquid preparations as well as creams; its surface-active properties make it interesting as an auxiliary emulsifier and surface-active agent in certain formulations.

Basic tetracycline

As a result of an alliance between Aspro-Nicholas Ltd. and Lepetit S.p.A. of Milan, a new anti-biotic, *Ambramycin*, is to be marketed in the U.K.

Ambramycin is the basic tetracycline hydrochloride without additives. In this form it is claimed to be more stable, produce less side effects, provide higher blood levels and better C.S.F. penetration than either chlortetracycline or oxytetracycline.

Capsules of 250 mg., coloured yellow and amber, are available in bottles of 16, 60 and 250 at basic N.H.S. prices of 29s., 104s. 6d., and £21 3s. 4d. respectively.

Chocolate flavoured oral suspension containing amphoteric tetracycline base equivalent to 2·5% tetracycline hydrochloride is available in bottles of 60 ml. at 10s. 10d.

Parasite killer

Tests which have achieved the complete eradication of red mite—the most serious of parasites affecting poultry and a major cause of egg losses—have been announced by Boots.

Research carried out over the past two years has resulted in a new product to be known as Boots Poultry Mite Killer.

Based on a new insecticide—*Sevin*, a compound of the Union Carbide Corporation—Boots Poultry Mite Killer is applied to an infested poultry house by spray.

Generally one spray will give complete control of red mite for a whole season.

The new product costs 12s. 6d. for a pack which makes 10 gal. of spray—sufficient to treat a poultry house of 650 birds.

Epilepsy control

Better control of epilepsy is claimed for *Elipten*, a member of a new chemical series with anticonvulsant properties, developed in the Ciba research laboratories, U.S.A. Its discovery resulted from a study of compounds related to *Doriden*, a Ciba sedative, which also possessed mild anticonvulsant properties, in addition to inducing sleep.

Although of the same chemical family as Doriden, Elipten (amino-glutethimide) does not put patients to sleep—but does control the convulsions that characterise epilepsy. It appears to do this by exerting a specific dampening action on that part of the brain where the nerve impulses which control muscular movement originate.

Garden and greenhouse insecticides

Boots have introduced two new insecticides—a greenfly killer and a greenhouse pest product.

The greenfly killer is based on malathion and it can be used on fruit, flowers and vegetables. It is also claimed to kill blackfly. The 4 fl. oz. bottle costs 2s. 6d. and is sufficient to make 8 gal. of spray.

The greenhouse product is based on malathion, lindane and chlorbenside. It is called Boots Greenhouse Insecticide and controls a wide variety of insect pests under glass, including greenfly, blackfly, thrip, leaf hopper, white fly, leaf miner and red spider.

In a press button fumigator, it is sprayed into the air above the plants. One container, which costs 5s., will treat a house of 500 cu. ft. ten times.

Asthma control

The Distillers Co. (Biochemicals) Ltd. have introduced *Asmaval* tablets which combine *Distaval* brand thalidomide, a non-barbiturate sedative, with ephedrine hydrochloride.

The product is indicated as a routine preventive measure against attacks of asthma, including bronchospasm associated with chronic respiratory disease.

Each tablet contains: Thalidomide 12·5 mg. ($\frac{1}{5}$ grain) and ephedrine hydrochloride 20 mg. ($\frac{1}{3}$ grain).

Tubes of 25 tablets retail at 3s. and bottles of 100 at 9s. (no P.T.).

Granular penicillin

Glaxo Laboratories have introduced a granular preparation of penicillin G for syrup under the name *Crystapen* G Syrup and available in bottles of 12 doses (each of 125 mg. penicillin G as potassium salt). The granules retail at 8s. 6d. per bottle and are packed for a shelf life of 12 months. The resultant syrup can be stored satisfactorily by the patient for four days at room temperature.

Another introduction is *Intrathecal* (Freeze-Dried) Benzylpenicillin. Packed in box of three 5 ml. capacity ampoules. Each ampoule contains 20,000 units of freeze-dried benzylpenicillin.

Antihypertensive agent

A drug which promises to control even the more severe forms of high blood pressure with a single daily dose is now available.

Called *Ismelin* (guanethidine sulphate), the new antihypertensive agent is claimed to have successfully reduced blood pressure to normal or near-normal levels in 80–90% of the hypertensive patients treated.

Developed by CIBA, *Ismelin* prevents the release of the blood pressure-elevating substance, noradrenaline.

Unlike other antihypertensive drugs, Ismelin works directly at the constricted arteriole.

It is expected to prove particularly beneficial in cases where other drugs have induced tolerance or unpleasant side effects.

Seen at the launching of Fraser Chemicals Ltd. were (left to right) Mr. H. Vallender, A.B.C.M., Mr. G. Oppenheim, I.C.I., Mr. N. Martin, "Manufacturing Chemist," and Mr. J. V. Head, Monsanto Ltd.

New chemical firm launched

Two personalities in the British and European chemical fields, Alastair Fraser and Michael Apor, have joined forces to set up Fraser Chemicals Ltd., and have opened their London offices at 9 West Halkin Street, Belgrave Square, London S.W.1.

Mr. Fraser, who was commercial manager and director of Hickson and Welch Ltd. before becoming managing director of Protim Ltd., has lately been developing English representations for a number of European manufacturers who are now turning to the British market.

Michael Apor began his career in the chemical industry in Hungary. After the war he established himself in Italy, specialising in the introduction of new anti-corrosion and anti-oxidisation products. He has also been connected with the fermentation industry in Italy. He now plans to offer manufacturers the opportunity of exchanging and utilising new processes and developments. He is particularly interested to hear from research institutes investigating new fermentation products and techniques.

Changes in Poisons List

Statutory Instruments amending the Poisons List and the Poisons Rules are being prepared to give effect to recommendations made to the Home Secretary by the Poisons Board after considering the representations received in respect of the proposed amendments announced in the Home Office Notice of February 10, 1960. The following changes in the Poisons List and Rules are proposed:

1. The heading "Androgenic and oestrogenic substances, the following" and the subordinate entry "Steroid compounds with androgenic or oestrogenic activity; their esters" in Part I of the Poisons List and Part B of the Fourth Schedule to the Poisons Rules will be amended to read respectively "Androgenic, oestrogenic and progestational substances, the following" and "Steroid compounds with androgenic or oestrogenic or progestational activity; their esters."

2. The entries in Part I of the Poisons List and Part B of the Fourth Schedule to the Poisons Rules relating to the alkaloids of rauwolfia will be amended to include a reference to their derivatives and the salts of their derivatives, and carbethoxysyringoylmethylreserpate and its salts will be separately included in Part I of the List and Part B of the Fourth Schedule.

3. Ethinamate, glutethimide and its salts, and methyprylone will be added to Part I of the Poisons List and Part B of the Fourth Schedule to the Poisons Rules.

4. The phenothiazine derivative methoxanate, and its salts, will be exempted from the provisions of the Pharmacy and Poisons Act and the Poisons Rules.

5. The entries relating to the active principles of the suprarenal gland and their salts in Part I of the Poisons List and the Sixth Schedule to the Poisons Rules will be amended to refer only to the active principles of the medulla of the gland and their salts, and these substances will be added to Part B of the Fourth Schedule to the Rules, with exemption for preparations intended for external application only, and inhalants, containing them.

6. The entry relating to the active principles of the pituitary gland will be deleted from the Seventh Schedule to the Rules and these substances will be added to Part B of the Fourth Schedule, with exemption for preparations intended for external application only, and inhalants, containing them.

7. The entry "Phenylbutazone, its salts" was made in Part A and in Part B of the Fourth Schedule to the Rules; it will be deleted from Part A.

Land deal by Reichhold

Reichhold Chemicals Ltd. have exchanged contracts for the purchase of a freehold factory site at Havant, Hants.

PANAMA

Measles vaccine

American doctors have successfully tested a measles vaccine during an epidemic in Panama. Measles was thirteen times more frequent in the non-vaccinated control group than in those who were given the vaccine.

The vaccine consists of live, attenuated virus giving a level of protective antibodies in the blood comparable to those resulting from natural attack, which suggests that immunity resulting from the vaccine may be long-lasting.

Although the vaccine showed great success with children under five, it also caused marked reactions in many children of this age. This might be acceptable in places like Panama where many children die from the disease, but in areas like Britain the vaccine will have to be weakened without loss of protective power, before it can be used.

It is also reported from Japan that Dr. Seiji Arakawa of the Infectious Disease Research Institute of Tokyo University has produced a vaccine which can be used for both preventive and convalescent purposes in cases of measles.

It has been found that the vaccine helps to reduce the severity of measles by sharply reducing the patient's fever. The vaccine does not produce any after-effects.

PAKISTAN

Drug manufacture

The Government have permitted Opal Laboratories, in collaboration with Archifar Laboratories of Italy, to start the basic manufacture of choramphenical, antimalarials and anti-TB drugs.

The technical director of Archifar, Dr. Giorgio Giommoni, is now in Karachi. The sponsors hope the products will be on sale in October.

KENYA

£26,000 Pyrethrum sampling controversy

The Pyrethrum Board of Kenya is to apply for leave to appeal to the Privy Council against a judgment announced on June 22 in Nairobi by the Court of Appeal for Eastern Africa in favour of the East African Extract Corporation, a subsidiary of Mitchell Cotts and Co. Ltd.

The decision reversed the judgment of the Supreme Court of Kenya of August 28, 1959, in favour of the Pyrethrum Board in the test case over hand sampling as against mechanical sampling of pyrethrum flowers.

It was then ruled that the Board's hand sampling method was the correct one, and the Supreme Court rejected the Corporation's claim for a refund totalling £25,675 against the Board, which the Corporation said it had overpaid on 500 tons of pyrethrum deliveries from the Board between April and June 1958.

The flowers must be sampled to establish the average content in each batch of the insecticidal pyrethrins found in the flower heads. On this content the price of the batch is based.

In the new judgment the Court said that it was far from satisfied, and found it impossible to say, that either method—the Board's hand sampling, or the Corporation's machine method—was more accurate than the other.

The Court decided that the true result of sampling rested somewhere between the two respective methods. Therefore the onus of proof was on the Board to prove that its sampling method was more accurate. This the Board had failed to prove, and the Court ordered a refund to the Corporation of £25,675 in respect of overpayments on 500 tons of flowers.

Ruling in favour of the Pyrethrum Board, the Court refused to order that the Nairobi sample price should apply until June 1961, and said that samples taken at Nairobi govern the price for the three-months period April to June 1958 only.

INDIA

Glaxo subsidiary makes vitamin A constituent

Beta-ionone, the starting material in the manufacture of vitamin A, is now being produced by the Indian subsidiary of Glaxo Laboratories at its fine chemicals factory at Worli. At present the whole output of beta-ionone is exported to this country and Glaxo (India) are manufacturing their own vitamin A from imported intermediates.

However, when the company's new plant at Thana is completed it is expected that vitamin A palmitate will also be synthesised from the beta-ionone made there. Beta-ionone will also be exported to other Glaxo factories.

Beta-ionone is manufactured from lemon-grass oil produced in south India. The manufacturing process was developed by the parent company for its Indian subsidiary as India is one of the largest growers of lemon-grass. Indian personnel, under training with the U.K. company at the time, were associated with the development of the manufacturing techniques and are now taking part in beta-ionone manufacture at Bombay.

The Worli Fine Chemicals Division has been operating since 1958. Glaxo is one of two companies manufacturing vitamin A in India and the only company producing corticosteroids on a large scale.

The first building scheduled for completion at the Thana site is for vitamin A production and work has also started on the construction of a corticosteroids plant.

AUSTRALIA

Fluorocarbons venture

Pacific Chemical Industries Pty. Ltd. has been formed in Sydney with an authorised capital of £1 million to manufacture chemicals starting with a range of fluorocarbons—types used as propellants in pressure packs and refrigerants in household and industrial air conditioners and refrigerators. The company is a joint venture of Australian Cream Tartar Co. Pty. Ltd. and the Ugine group of France. It has been licensed by the Stauffer Chemical Co. of U.S.A., a major shareholder of A.C.T., to operate Stauffer's hydrofluoric acid process.

Acid output up

In the first three months of the current calendar year Australian production of sulphuric, nitric and hydrochloric acids showed good increases. Output of fertilisers was also up. But the production of refined glycerine fell from the 24,700 cwt. of the previous comparative period to 21,300 cwt.

Cosmetic materials wanted

Australia is not self-sufficient in the supply of basic raw materials for the cosmetics industry. In the year to June 30 last the value of imported perfumes was £557,411 compared with the £496,248 of the previous 12 months. Many creams, nail lacquers, etc., are manufactured from overseas formulæ calling for proprietary brands of raw materials which also have to be imported. In recent years, output of face powders and rouge have declined badly, but production of hair preparations has increased. On a *per capita* basis, Australia is perhaps the largest market for cosmetics after the U.S.A.

Tariff protection

Speaking at the opening of the new £500,000 Eli Lilly (Australia) Ltd. drug manufacturing laboratories at Ermington, Victoria, the Acting Prime Minister and Minister for Trade, Mr. McEwen, promised tariff protection for Australian industries. "The Government's policy is to use the tariff to protect economic and efficient local industries against imports," he said.

Chemical expenditure

In the past three years the Australian chemicals and oil refining industry has spent heavily on capital projects. In 1957 the total was £26,500,000; in 1958 it was £30,800,000; and in 1959 £29,500,000.

ARGENTINA

Givaudan factory

Pilot plant production has been started in the new factory of Givaudan Argentina S.A., The company was organised in 1955 to serve the expanding soap, perfume and cosmetic industries of the Argentine. The new plant will be located in the town of Gutierrez, 20 miles from the Argentine capital, on the river Las Conchitas. On a 30-acre plot of land, the production facilities are being planned for development and expansion as required by the industry.

In the village of Bernal, a suburb of Buenos Aires, compounding and research operations are already being conducted in a modern building owned by the company. Here, all compound requirements of Argentine customers can be fulfilled with allowances for future expansion. An analytical control laboratory is also nearing completion. The company has also acquired additional property in the vicinity of the plant area for building private homes.

HUNGARY

Heavier investment in chemicals

New directives to industrial planners to ensure that the chemical industry develops faster than other industries have been issued by the Socialist Workers' Party in Hungary.

Following a review of progress in preparation of the Second Five Year Plan, due to commence next January, the Party's Central Committee said that one-sixth of the country's entire industrial investment would go into the chemical industry during that period. Half of that sum would go to develop production of artificial fertilisers, synthetic materials and synthetic yarns.

" As these materials can on the whole be manufactured more economically from mineral oil and natural gas than from coal," the Committee stated, " and as both can be obtained from home sources and from countries of the socialist camp, we must rely on oil and gas for the development of our chemical industry."

(Last year Hungary completed a methane gas pipeline to the Rumanian fields. She also has gas resources of her own and is prospecting for more. By 1962 the new pipeline now being built from the Soviet Union will be bringing in 2,500,000 tons of oil a year.)

The Committee went on to ask the National Planning Office and the leaders of various ministries to initiate further development of work division among the socialist countries. They should also ensure that the output of the Hungarian engineering industry was adjusted to ensure that, without building further factories, the engineering requirements of the chemical industry were better met.

The planning office and ministries were also told to see that the plan ensures harmony between the synthetic materials production and processing sides.

Suggestions were also called for to overcome the fact that chemical industry production at present comes under the jurisdiction of several ministries and that " neither production nor research are satisfactorily harmonised."

Geological research for opening up natural gas and mineral oil production has to be modernised and stepped up, and building of pipelines speeded up.

Importation of complete modern plants from abroad must also be speeded up, the Committee said.

New plants from abroad

It was recently announced that the Krebs Co., Paris, is to supply equipment and machinery for two new chemical plants in Hungary.

One, in Budapest, will have an annual output of 10,000 tons of chlorine, 11,000 tons of caustic soda and 19,000 cu. m. of hydrogen, and will come into operation in 1962.

The other, to be built at Berente, in northern Hungary, will supply raw materials to a new PVC plant, which in turn will be equipped with installations and machinery from the West German Friedrich Uhde G.m.b.H. firm, Dortmund.

NEW ZEALAND

Glaxo staff appointed

Several members of Glaxo Laboratories' veterinary staff are being transferred to the company's New Zealand subsidiary company at Palmerston North. They have been undergoing special training at Glaxo's veterinary research unit at Greenford, Middlesex, preparatory to taking up appointments in new laboratories being built at Palmerston North for the manufacture of veterinary vaccines.

Glaxo plans to manufacture a wide range of veterinary vaccines in New Zealand and, later, in Australia.

Head of the New Zealand project will be Mr. D. Jull, who qualified at the Royal Veterinary College, London and in 1953 emigrated to New Zealand.

SOUTH AFRICA

Cosmetics factory

Revlon Inc. of America have opened a new factory in Johannesburg (their first in Africa) to handle the manufacture and distribution of Revlon cosmetics in Southern Africa and adjoining territories. It is hoped that exports will be possible later to the wider African market.

Modern Materials for Insulation

The current (August) issue of **Fibres and Plastics** reviews materials for acoustic, thermal and electrical insulation. Articles on this subject include: " Silicone Dielectric Materials," " Reinforced Plastics in Electrical Insulation," " Phenolic Laminates in Insulants " and " Laminated Plastics for Electrical Insulation." Other articles include " Medium Density Polythenes in Coatings," " An Introduction to Reinforced Plastics," " Progress in Antistatics for Textiles " and " Japan's Chemical Fibres."

In **Chemical and Process Engineering** this month there is a special feature on " Dust Control and Prevention." There is also an article on the latest developments in dust control plant. Further subjects of interest are " Materials of Construction for Chemical Plant," which describes the use of stainless steel in this context, and " Estimation of Dilution Calculations."

In **Corrosion Technology,** one of the more rare metals now coming into use in rocketry is dealt with in a short article entitled " Oxidation Characteristics of Niobium." Overseas sales departments will find " Packaging of Metallic Goods for Export and Procedure to Avoid Corrosion " of interest. Other articles include " Pitting Corrosion," " Soil Micro-organisms in Relation to Cathodic Protection," " Corrosion Inhibitors in Refinery Process Streams " and " Low Pressure Enamel Spraying Technique."

Automation Progress publishes a survey on digitising, discussing modern techniques, position and step-counting methods. The present development of optical digitisers is also reviewed. In an article on data processing a system is described of reading typed characters automatically and applications in industry. A new low cost memory device is reported in the feature on computers.

" The World's Largest Wax Plant " at Philadelphia operated by the Atlantic Refining Co. is featured in **Petroleum.** Of interest, amongst other articles are " Newer Organic Chemicals in Metal Protection and Lubrication " and " Compressed Hydrocarbon Gases as a Solvent."

World Crops produces a special number dealing with farm vehicles and the Royal Show and also reports on controlling by fungicide rust disease of coffee.

Leiner's gelatine plant at Treforest is discussed in **Food Manufacture.** There is a special survey of canning machinery.

Articles in **Dairy Engineering** include " Automatic Blending of Butter," " Running a Dairy Transport Fleet " and " Colombia's Contribution to Dairying in South America."

Paint Manufacture prints an interesting article on " Paraformaldehyde in Alkyd Resins." Printing inks are covered in " The Selection of Resins for Printing Inks " and " Lanolin in Inks."

Specimen copies of the journals containing these valuable articles can be obtained from The Circulation Manager, Leonard Hill House, Eden Street, London, N.W.1.

THE CHEMICAL MARKET

MOST PRICES HOLD FIRM

LONDON.—The market this month remains fairly stable. Ethyl and potassium **iodide, pentachlorphenol, caustic soda** and **hydrated potassium carbonate** are dearer. **Tartaric acid, nicotinamide, thiamine hydrochloride** and **sodium sulphite** are cheaper.

There are the usual fluctuations in the market for oils, fats, gums and waxes. Generally prices are higher.

FINE CHEMICALS

Acetanilide 12½ kg. 7s. 4d. kg.
Arsenic trioxide
5 to 10-ton lots £35 ton
Ascorbic acid
100 kg. £4 14s. kg.
Aspirin
56 lb. 5s. lb.
1-cwt. lots 4s. 11d. ,,
5-cwt. lots 4s. 9d. ,,
Atropine
Sulphate, 500 g. £59 18s. 6d. kg.
Alkaloid, 500 g. £68 15s. kg.
Benzene B.P.C. 28-lb. lots 1s. 8d. lb.
Benzoic acid 12½ kg. 7s. 4d. kg.
Benzyl benzoate
According to pack 4s. 11d. to 7s. 2d. lb.
Bismuth oxide B.P.C. 1934
28-lb. lots 26s. 10d. lb.
Bismuth salts 28-lb. lots:
Carbonate 22s. 3d. lb.
Subgallate 21s. 1d. ,,
Salicylate 21s. 9d. ,,
Subnitrate 20s. 5d. ,,
Borax B.P.
Powder £60 10s. ton
Extra fine £61 10s. ,,
Boric acid B.P.
Crystal £99 ,,
Powder £96 10s. ,,
Bromine B.P.C. 7-lb. lots 6s. lb.
Caffeine 50 kg. 42s. 6d. kg.
Calamine 50 kg. 4s. kg.
Calcium gluconate
1-cwt. lots dlvd. 3s. 7d. lb.
Calcium glycerophosphate
50 kg. 28s. 6d. kg.
Calcium lactate B.P.
28-lb. lots 2s. 7d. lb.
1-cwt. lots 2s. 4d. ,,
Chloral hydrate 50 kg. 10s. kg.
Citric acid, B.P. Powder or granulated:
1-cwt. lots in bags 212s. cwt.
5-cwt. lots ,, ,, 208s. ,,
Codeine
Alkaloid 100 g. £138 10s. kg.
Phosphate 100 g. £110 ,,
Cream of tartar
1-cwt. lots £12 5s. cwt.
5-cwt. lots £12 3s. ,,
Ephedrine
Hydrochloride 3 kg. £7 1s. 1d. kg.
Alkaloid 3 kg. £12 7s. ,,
Sulphate 3 kg. £7 1s. 1d. ,,
Eucalyptol
1-cwt. lots 11s. lb.
5-cwt. lots 10s. 6d. ,,
Ferri ammonium citrate B.P.
1-cwt. lots, scales 4s. 5½d. lb.
1-cwt. lots, granules 3s. 7½d. ,,
Ferrous gluconate
1-cwt. lots dlvd. 6s. 3d. lb.
Gallic acid B.P.C.
1-cwt. lots 10s. ,,
Gluconic acid technical 50%
Minimum 12-gal. drums
19s. gal., drums extra, returnable
Glucono delta lactone
1-ton lots dlvd. 5s. net lb.
Glycerophosphoric acid
24 litres 11s. 10d. litre
Glycine (amino acetic acid)
12½ kg. 18s. 10d. kg.
Hexyl resorcinol 10 kg. £7 10s. ,,
Hydroquinone 12½ kg. 23s. 10d. ,,
Iodides
Ethyl 4 kg. bottles 62s. 9d. kg.
Mercury, red B.P.C.
12½ kg. lots 58s. 6d. ,,
Potassium B.P.
12½ kg. lots 16s. 6d. ,,
Sodium B.P.
12½ kg. lots 22s. ,,
Iodine, Chilean crude,
99% min. in wooden casks 15s. kg.
Iodoform
12½ kg. and under 50 kg. 42s. 6d. kg.
Lactose 50 kg. 3s. 2d. kg.
Lithium salts 5-cwt. lots
Benzoate 10s. lb.
Carbonate B.P.C. 11s. 3d. ,,
Chloride (commercial) powder
11s. ,,
,, granular 10s. 9d. ,,
Hydroxide 9s. 9d. ,,
Citrate B.P.C. 9s. ,,
Sulphate 8s. 6d. ,,
Salicylate, 10 cwt., dlvd. 9s. 9d. ,,
Magnesium carbonate B.P.
Light cwt. lots dlvd. £129 ton
Magnesium trisilicate 28-lb. packs
28-lb. lots 4s. 3d. lb.
1-cwt. lots 3s. 10d. ,,
5-cwt. lots 3s. 7d. ,,
Bulk rates for larger quantities are from 3s. 1d. lb. in 1-ton lots
Manganese hypophosphite B.P.C.
7-lb. lots 13s. 11d. lb.
1-cwt. lots 12s. 11d. ,,
Mercuric chloride B.P.
50-kg. lump 48s. 6d. kg.
Methyl salicylate 1-cwt. lots 3s. 3d. lb.
Morphine
Alkaloid, 100 g. £138 18s. 4d. kg.
Nicotinamide 1 kg. £2 10s. 6d. kg.
Nicotinic acid
12½ kg. 32s. 9d. kg.
1 kg. 35s. ,,
Oleine, B.P. extra pale, 3/4 cwt. drums returnable carriage paid G.B.
£160 ton
Phenolphthalein 50 kg. 24s. 3d. kg.
Phosphoric acid B.P.
(s.g. 1·750) 10-carboy lots 1s. 4d. lb.
Potassium permanganate B.P.
1-cwt. lots dlvd. 1s. 11¾d. lb.
Procaine hydrochloride (foreign)
2 kg. 59s. kg.
Quinine 1-oz. lots 4s. 4d. oz.
Riboflavin
100 g. 5½d. g.
10 g. 7d. ,,
Saccharin
500 g. £7 4s. for this quantity
Salicylic acid
B.P., dlvd. 3s. 2½d. to 5s. 6d. lb.
Silver nitrate
500 g. 5s. $2\frac{5}{16}$d. oz.
Sodium benzoate B.P.
1-cwt. lots 2s. 9½d. lb.
1-ton lots 2s. 7½d. ,,
Sodium gluconate technical
3-cwt. lots dlvd. 3s. net lb.
Sodium salicylate
50 kg. 8s. 8d. kg.
12½ kg. 9s. ,,
Sodium thiosulphate
Crystals, photographic quality
1-ton lots 49s. cwt.
Stearic acid B.P.C. flake, carriage paid G.B. £154 ton
Strychnine 25 oz.
Alkaloid 11s. 3d. oz.
Hydrochloride 11s. 3d. ,,
Sulphate 10s. 3d. ,,
Sulphaguanidine
12½ kg. 33s. kg.
50 kg. 32s. ,,
Sulphanilamide
12½ kg. 16s. 6d. kg.
50 kg. 15s. 4d. ,,
Sulphathiazole 12½ kg. 39s. 9d. ,,
Tannic acid B.P. Levis
1-cwt. lots 10s. lb.
Tartaric acid, B.P.
Powder or granulated,
10 cwt. or more £15 cwt.
Terpineol B.P.
40-gal. drums 2s. 4½d. lb.
1-cwt. lots 2s. 7d. ,,
Theophylline B.P.
500 g. 27s. 6d. for this quantity
Thiamine hydrochloride
100 g. 3d. g.
1 kg. £9 5s. kg.
Thioglycollate
Ammonium 12s. 4d. to 16s. 4d. lb.
Calcium:
7-lb. lots 17s. 3d. ,,
5-cwt. lots 14s. 3d. ,,
α-Tocopherol 25-g. lots 11d. g.
Vanillin 23s. 6d. lb.
Zinc oxide B.P.
2-ton lots dlvd. £115 ton

GENERAL CHEMICALS

Acetic acid 1-ton lots dlvd.
80% Technical £99 ton
80% Pure £105 ,,
Glacial B.P. £114 ,,
99-100% Glacial £111 ,,
98-100% Glacial £108 ,,

Acetic anhydride
1-ton lots dlvd. £128 ton

Acetone
5-gal. drums, free, non-returnable £124 ton
40 to 45-gal. drums, 10-ton lots £80 „

Alum, potassium granular crystals
50 kg. 1s. 2d. kg.

Aluminium hydroxide B.P.C. 34
28-lb. lots 2s. 4d. lb.

Aluminium stearate
(Precipitate) 1-ton lots £253 10s. ton

Ammonia
Persulphate £6 13s. 6d. cwt.
Phosphate: Mono- £106 ton
Di- £97 10s. „

Amyl acetate
B.S.S. 10 tons and over £251 ton
Technical £249 „

Amyl alcohol
Technical in 1-ton lots £256 ton

Arsenic White powdered ex store £42 ton

n-Butyl acetate
10-ton lots in drums £165 ton

n-Butyl alcohol
10-ton lots in drums £137 10s. ton

Calcium chloride
Solid and Flake, dlvd. in 1-ton lots £16 10s. ton

Calcium oxide (Lime)
Ex marble 28-lb. lots 3s. 10d. lb.

Caustic soda
Solid in drums, dlvd. £37 16s. 6d. ton
Flake 3¼-cwt. lots £39 0s. 6d. ton

Chloroform B.P. ½-ton lots 2s. 11½d. lb.

Chromic acid
Dlvd. U.K. (less 2½%) 2s. 0½d. to 2s. 0¾d. lb.

DDT 3s. 0½d. to 3s. 2d. lb.

2 : 4-Dichlorophenoxyacetic acid
99% pure, 1-cwt. bags £320 ton

Dimethyl sulphate 440 lb. drum lots 1s. 8d. lb.

Ether (Diethyl ether)
Tech. B.S.S. and Solvent B.P.
1-ton lots in drums 2s. lb.

Ethyl acetate 10-ton lots £137 ton

Ethyl alcohol
95% Gay Lussac 66·0 o.p.
over 300,000 proof gallons per year in tank wagons
3s. 2¾d. per proof gal.

Ferrous sulphate 50 kg. 1s. 4d. kg.

Formaldehyde
40% by volume dlvd. England
1-ton lots £39 15s. ton

Glycerin
1·2627 s.g. chem. pure, 5 tons and up, 5-cwt. drums £241 10s. ton
1·2627 s.g. technical grade, 5 tons and up, 5-cwt. drums £236 10s. ton

Hexamine
1-ton lots
Technical, bulk 1s. 7½d. lb.
B.P.C. 1s. 10½d. lb.

Hydrochloric acid
Commercial 18s. 6d. cwt.

Hydrogen peroxide
27·5% weight £115 ton
35% weight £138 „

Lactic acid (1-ton lots)
Pale tech. 44% by weight 1s. 3½d. lb.
Dark tech. 44% by weight 9½d. lb.

Magnesium chloride
Solid (ex wharf): 1-ton lots £18 10s. ton

Magnesium sulphate £15 ton

Mercurous chloride (calomel)
50 kg. 65s. kg.

Mercury sulphide, red
Ton lots and over 30s. 6d. lb.

Methylated spirits (Industrial)
Perfumery quality 500 gal. and upwards: gal.
64 o.p. 7s. 4d.
74 o.p. 7s. 11d.
5 gal.:
64 o.p. 8s. 7½d.
74 o.p. 9s. 2½d.

Methyl ethyl ketone
10 tons dlvd. in drums £134 10s. ton

Methyl isobutyl carbinol
10 tons and up, in drums, dlvd. £159 ton

Naphthalene
Crystal, dlvd., 4-ton lots, spot £66 ton
Ball and flake (ditto) £86 15s. „

Nickel sulphate
dlvd. ton lots £189 ton

Nitric acid 70% intermediate £36 ton

Pentachlorphenol
Flake, technical, in 100 lb. fibre/steel kegs dlvd. 2s. 4d. lb.

Phenol Ice crystals:
Under 1 ton dlvd. from 1s. 6d. lb.
10 tons and over dlvd. in returnable 450 drums from 1s. 3d. lb.

Phthalates
10-ton lots in drums
Diethyl (B.S.) £187 10s. ton
Dimethyl (B.S.) £179 ton

Potassium bromide
50 kg. 5s. 6d. kg.
12½ kg. 5s. 8d. „

Potassium carbonate
Calcined 96 to 98% (1-ton lots ex store) in bags £75 10s. ton
Hydrated (1-ton lots) £74 „

Potassium fluoride
28-lb. lots 5s. 1d. lb.

Potassium sodium tartrate
5-cwt. lots £10 cwt.

Soda ash
1-ton lots non-returnable bags 2 cwt. bags £19 6s. 6d. ton

Sodium hydroxide 28-lb. lots:
sticks (1-lb. bottles) 4s. 3d. lb.
pellets „ „ 3s. 9d. „

Sodium metal 28-lb. lots 3s. 8d. „

Sodium metasilicate
Dlvd. U.K. in ton lots £26 ton

Sodium phosphate
Dlvd. ton lots: Di-sodium, crystalline £40 10s. ton
Anhydrous £88 „
Tri-sodium, crystalline £39 „
Anhydrous £86 „

Sodium silicate
dlvd. in drums £17 ton

Sodium sulphate Ex works:
(Glauber salt) £13 ton
(Salt cake) unground, full truck loads £8 16s. 6d. ton

Sodium sulphide
Broken, returnable drums, dlvd. ton lots £37 2s. 6d. ton
Flake, ditto £38 12s. 6d. „
Solid ditto £36 2s. 6d. „

Sodium sulphite
Commercial crystals £38 ton
(Dlvd. London in 1-cwt. single non-returnable bags)

Sodium tripolyphosphate
1-ton lots £95 ton

Stannic chloride 28-lb. lots 8s. 11d. lb.

Stannous chloride 28-lb. lots 9s. 5d. lb.

Strontium carbonate
96-98% 28-lb. lots 3s. lb.

Sulphuric acid, ex-works, according to quality and quantity
B.O.V. 78% from 8s. to 10s. cwt.
C.O.V. 96% from 11s. to 14s. cwt.

Zinc chloride
28-lb. lots sticks 6s. 9d. lb.

OILS AND FATS

Palm kernel oil
Refined, deodorised, 2-ton lots, naked, ex-works £128 ton

Palm oil
Refined, deodorised, 2-ton lots, naked, ex-works £102 ton

Stearine
dlvd. free bags
Pristerene 64 flake £148 ton
Pristerene 62 flake £133 „
Pristerene 61 flake £113 „
A premium of £2 ton is charged for powder and £4 for block

GUMS AND WAXES

Agar Agar No. 1
Kobe strip 16s. 9d. lb.
Powder 21s. „

Beeswax
Dar-es-Salaam spot (nominal) £26 10s. cwt.
Sudan spot (duty paid) £24 „
Bleached white (slab) £29 10s. „
Refined yellow (slab) £26 10s. „

Benzoin
Sumatra spot £26 10s. cwt.
Siam spot £2 7s. 6d. lb.

Candelilla Spot £24 5s. cwt.

Carnauba
Prime, Spot £41 10s. cwt.
Fatty grey £30 „

Gum arabic Lump £9 5s. cwt.

Karaya Powder, Spot 3s. 4d. lb.

Paraffin wax
1-ton lots, acc. to grade £105 to £130 ton

Peru balsam 10s. 3d. lb.

Shellac
No. 1 orange £14 cwt.
No. 2 orange £12 10s. „
Transparent white 4s. 3d. lb.
Pale dewaxed 6s. „

Tragacanth
No. 1 spot £137 cwt.
No. 2 spot £120 „
Pale leaf £50 „
Amber £38 „
Brown to Red £27 „

NEW TRADE MARKS

APPLICATIONS

Cosmetic and toilet preparations

SKINFRES.—B793,783. *D.D.D. Company Ltd.*

AVANTI.—796,159. *Ashe Laboratories Ltd.*

ODEX.—796,160. *Odex Ltd.*

LIPSIN.—797,688. *Ashe Laboratories Ltd.*

" DEORANT ".—782,772. *Antoine François Regis Peyron.*

WORTH.—787,714. *Worth Parfums S.A.*

VERVE.—795,910. *Audley Bowdler Williamson.*

WELLASTRATE.—797,290. *Wella Rapid Ltd.*

SUNIL.—797,611. *Lever Brothers, Port Sunlight, Ltd.*

VITA MOIST.—790,134. *Avon Products Inc.*

YAXA ROLL-ON.—794,360. *Perplex Ltd.*

IMPERTINENCE. — 798,314. *Société Technique de Parfumerie " F. Millot."*

MAS.—792,165. *Mas Perfumeries Ltd.*

DEWFRES.—793,780. *D.D.D. Company Ltd.*

CASTEL BLEU.—B795,359. *Etablissements Chevallier.*

DYSTAKOL.—796,657. *J. M. Loveridge Ltd.*

LIP WAND.—B797,689. *Ashe Laboratories Ltd.*

GARINOR.—798,101. *Roche Products Ltd.*

INTERLUDE.—798,541. *Merton Ian Behrman.*

INFAMY.—798,542. *Merton Ian Behrman.*

PEARLMARIN.—771,426. " *Goldwell* " *G.m.b.H. Chemische Fabrik H. E. Dotter.*

BLUE HEAVEN.—796,735. *Akos Chemicals Ltd.*

EYLURE-LIQUA-LINER. — 797,431. *Eylure Ltd.*

POLYDERM.—798,595. *Chesebrough-Ponds Inc.*

ROCKET.—800,832. *Lincoln Hair Products Ltd.*

Pharmaceuticals

TOLAPAS.—793,470. *J. T. Smith and Nephew Ltd.*

LABO.—794,029. *Edwin Thorp and Son.*

OCTAFLEX.—795,121. *Ward Blenkinsop and Co. Ltd.*

TERIDOX.—795,317. " *Killgerm* " *Co. Ltd.*

NETHAPRYN. — 795,508. *Merrell-National (Laboratories) Ltd.*

TANFASTIC.—795,670. *Miners Make Up Ltd.*

PALAVIT.—795,790. *Palatable Vitamin Products Ltd.*

PLASTAWAY.—795,939. *Eschmann Bros. and Walsh Ltd.*

DAVOID.—795,970. *H. C. Moore Ltd.*

SUNNIMAX.—796,269. *E. E. Warne and Co.*

SCORVITE.—796,366. *Wigglesworth Ltd.*

POTABA.—796,743. *J. R. Cockton and Co. Ltd.*

BENDRALAN.—792,761. *Bristol Laboratories Inc.*

PENTRACILLIN.—792,955. *Beecham Research Laboratories Ltd.*

TAMODAC.—793,165. *Dales Pharmaceuticals Ltd.*

SKINFRES.—B794,265. *D.D.D. Co. Ltd.*

MOZIL.—795,100. *Boots Pure Drug Co. Ltd.*

SINBAD.—796,237. *Newlands Bros. and Mumford Ltd.*

NAN.—796,606. *The Nestlé Co. Ltd.*

DIJOZOL.—796,796. *H. Trommsdorff.*

FOROCIBEN.—797,309. *Ciba Ltd.*

ADZALEEN.—797,698. *Organon Laboratories Ltd.*

OTRICORTEN.—797,815. *Ciba Ltd.*

BENEFYL.—798,095. *Roche Products Ltd.*

CERMAPON.—798,371. *Westminster Laboratories Ltd.*

CILLERAL.—798,663. *Bristol Laboratories Ltd.*

ORANABOL.—798,777. *Società Farmaceutici Italia.*

INDUCTIN.—791,046. *Merck and Co. Inc.*

STELABID.—792,148. *Smith, Kline and French Laboratories Ltd.*

LIXABEN. — 792,736. *Anglo - French Pharmacals Ltd.*

HIPSY.—B793,148. *Paines and Byrne Ltd.*

LYSEENAL.—B795,028. *Joseph Henry Clarke.*

BRISTAMIN.—793,688. *Bristol Laboratories Inc.*

PULMIDOL.—795,336. *May and Baker Ltd.*

URELIM.—795,385. *Ward, Blenkinsop and Co. Ltd.*

DEBREX.—796,202. *Calmic Ltd.*

AMPLEX FOOT-FRESH. — 796,729. *Ashe Laboratories Ltd.*

MIZARH.—797,022. *Luscoe Products Ltd.*

TAMODAX.—797,145. *Dales Pharmaceuticals Ltd.*

FANASUL.—798,099. GABIOTAN.—798,100. MATALGON. — 798,106. RAGONIL. — 798,108. RIVOTRIL. — 798,111. TERIOSAL.—798,116. TIBERAL.—798,117. *Roche Products Ltd.*

SOLARCANE.—789,130. *Plough Inc.*

GLYCURATOR.—791,300. *Südemedica G.m.b.H.*

SOBEROL.—793,913. *Heiman Padova.*

CALCIMELA.—794,655. *C. H. Boehringer Sohn.*

TRESCATYL.—795,264. *May and Baker Ltd.*

PHOLCORBRON.—796,365. *Wigglesworth Ltd.*

AMIG.—796,390. *Wellcome Foundation Ltd.*

TUSSOBRON.—796,367. *Wigglesworth Ltd.*

ALBUMAID.—796,368. *Powell and Scholefield Ltd.*

VORAMIX.—796,733. *Ciba Ltd.*

NUTRIDERM.—797,861. *Organon Laboratories Ltd.*

STIMPLETE.—797,446. *American Home Products Corp.*

LUNORTIN.—798,741. *Parke, Davis and Co.*

EXPIGAN.—799,297. *A/B Pharmacia.*

VANOTENS.—799,541. *Wellcome Foundation Ltd.*

MU-CRON.—800,205. *International Laboratories Ltd.*

VETISULID.—793,877. *Ciba Ltd.*

THEREX.—794,912. *Vick Chemical Co.*

NOVIDREX.—795,893. *Ciba Ltd.*

SOLAVITE.—796,154. *Wellcome Foundation Ltd.*

TORBUTIN.—796,730. *Beecham Research Laboratories Ltd.*

RADOCONTRAL.—797,147. *C. H. Boehringer Sohn.*

ORAZONES.—797,684. *Meggeson and Co. Ltd.*

SEVENSEAS.—797,822. *Marfleet Refining Co. Ltd.*

NEO-KANTREX.—798,046. *Bristol Laboratories Inc.*

HALIN.—798,292. *Aspro-Nicholas Ltd.*

PONTORRIN. — 799,142. *Farbwerke Hoechst A.G.*

NEW PATENTS

COMPLETE SPECIFICATIONS ACCEPTED

Antibiotics

Process for obtaining vitamin B_{12} and vitamin B_{12}-like substances and the products thereof. *Chase Chemical Co.* 834,384.

Pharmaceuticals

Phenanthridinium compounds. *May and Baker Ltd.* 834,231.

Quinoline derivatives and the manufacture thereof. *Wellcome Foundation Ltd.* 834,300.

Phenothiazine derivatives. *Abbott Laboratories.* 834,370.

Tryptamine derivatives. *Laboratoires Français de Chimiotherapie.* 833,866.

Thiadiazoline sulphonamides and the preparation thereof. *American Cyanamid Co.* 834,285.

Organic mercury antiseptic solutions and method of preparing same. *Gallowhur Chemical Corporation.* 834,180.

Drug composition. *Rohm and Haas Co.* 833,458.

Therapeutic bone mixture. *Olin Mathieson Chemical Corporation.* 834,256.

L-amphetamine alginate. *Nordson Pharmaceutical Laboratories Inc.* 833,946.

Preparation of pyrrolidyl esters and quaternary compounds thereof. *Beecham Research Laboratories Ltd.* 833,820.

Preparation of piperazine. *Jefferson Chemical Co.* 833,589.

Pharmaceutical compositions containing 2-*P*-aminobenzenesulphonamido-5-t-butyl-1, 3, 4-thiadiazole. *Soc. des Usines Chimiques Rhône-Poulenc.* 828,963.

Herbicidal compositions. *Shell Research Ltd.* 828,871.

Diamine compounds and means of producing same. *Parke, Davis and Co.* 829,176.

N - *p* - hydroxylphenyl amides with choleretic action. *Farmaceutici Italia S.A.* 828,695.

Preparation of esters of amino acids and of peptides from proteins. *Armour and Co.* 828,978.

Preparation of substituted phenanthridine compounds. *Boots Pure Drug Co. Ltd.* 828,962.

Process for the production of a polyvitamin preparation. *Laboratories Français de Chimiotherapie.* 828,960.

Laxative agents. *Mundipharma A.G.* 829,068.

Vitamins

Process for the production of nicotinamide. *Abbott Laboratories.* 831,848.

Derivatives of thiamine and their production. *Takeda Pharmaceutical Industries Ltd.* 833,391.

Preparation of a vitamin product. *C. Pfizer and Co. Inc.* 831,985.

Purification of vitamin B_{12}. *Uclaf.* 833,067.

Pesticides

Basic ester of phosphorothiolic acid and pesticidal compositions containing it. *Imperial Chemical Industries Ltd.* 832,990.

Steroids

1,4,6-pregnatrienes. *Scherico Ltd.* 832,214.

Process of preparing a cortin-like product. *Laboratories Laroche Navarron.* 831,849.

Steroid compounds. *Laboratoires Français de Chimiotherapie.* 832,245.

Steroid process. *C. Pfizer and Co. Inc.* 832,116.

Steroid compounds. *Laboratoires Français de Chimiotherapie.* 832,244.

Hydroxylated steroids and methods for their manufacture. *Scherico Ltd.* 832,325.

Miscellaneous

Amides. *May and Baker Ltd.* 832,183.

Method of and apparatus for the manufacture of phosphoric acid. *Union Chimique Belge S.A.*, and *Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny et Cirey S.A. des.* 831,970.

Processes for producing substituted alkylamines and acid-addition salts thereof. *Philips' Gloeilampenfabrieken N.V.* 832,286, 832,287, 832,288, 832,289.

Process for the preparation of zinc and lead compounds. *Office National Industriel de l'Azote.* 833,231.

1 β-carboxy-S β hydroxy-8-ketohexahydronaphthalene lectone. *Laboratoires Français de Chimiotherapie.* 832,292.

Cyclopentanophenanthrene compounds. *Laboratoires Français de Chimiotherapie.* 833,183.

Production of pure aluminium hydroxide. *K. Broockmann.* 833,187.

5 : 5^1 - Dinitro - 2 : 2^1 - dichlorohydrobenzoin and its preparation. *Soc. des Usines Chimiques Rhône-Poulenc.* 833,161.

Amino-ketoses and process for their manufacture. *Ciba Ltd.* 833,263.

Process for the manufacture of 2-aminoaldohexoses. *Ciba Ltd.* 833,264.

Transformation of aromatic carboxylic acid salts. *Imperial Chemical Industries Ltd.*, and *P. A. Mason.* 833,019.

Process for the oxidation of organic compounds. *Imperial Chemical Industries Ltd.* 832,995.

Nicotinyl hydrazide. *C. Erba S.p.A.* 829,533.

Dithiacyclopentene derivatives. *Farbenfabriken Bayer A.G.* 829,529.

Purification of 4, 4'-dihydroxy-diphenylalkanes and cycloalkanes. *Farbenfabriken Bayer A.G.* 829,207.

Process for the production of pyrido (3, 2-d) pyrimidine compounds. *Parke, Davis and Co.* 829,276.

Manufacture of nitrogen-containing derivatives of benzene carboxylic acids. *Inventa A.G. für Forschung und Patentverwertung.* 829,251.

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NEW COMPANIES

These particulars of new companies have been extracted from the daily register of Jordan and Sons Ltd., company registration agents, Chancery Lane, London, W.C.2.

British Chrome and Chemicals Ltd. 13.4.60. Urlay Nook, Stockton-on-Tees, Co. Durham. £100. Dirs.: not named. Subs: R. G. Middleton and E. R. Clericetti.

Eaglescliffe Chemical Co. Ltd. 13.4.60. £100. Subs.: R. G. Middleton and E. R. Clericetti, St. Swithin's House, Walbrook, London, E.C.4.

Barrett and Weaver Ltd. 19.4.60. 86 Castle Rd., Southsea, Hants. Dispensing and genl. chemists. £1,000. Dirs.: P. R. Barrett and E. D. Weaver.

Charles G. Harbron Ltd. 19.4.60. 69 Beach St., Deal, Kent. To take over bus. of a chemist cd. on at Deal, Kent, by Olive C. Harbron as executrix of Charles G. Harbron. £500. Dirs.: Olive C. and Peter G. Harbron.

Harris and Brooker (Luton) Ltd. 25.4.60. Druggists and chemists. £100. Dirs.: not named. Subs.: C. G. Walton and P. E. Creed. 35 King Street, Luton.

Pink Top Ltd. 26.2.60. Glenborn, Holly St., Holly Hall, Dudley. Chemists, druggists, mnfrs. of toilet preparations. £100. Dirs.: Chas. W. Riley and Bernard Dandy.

Carsons Chemists Ltd. 29.2.60. 125 Goswell Rd., London, E.C.1. £100. Dirs.: Jeffrey and Mrs. Edna Carson.

M. Copeland (Wholesale) Ltd. 1.3.60. 3 Marsden St., Manchester 2. Chemists, etc. £100. Dirs.: Maurice and Shirley Copeland.

Devon Chemical Co. Ltd. 3.3.60. 15A Courtenay St., Newton Abbot, Devon. Mnfg. chemists. £100. Dirs.: G. W. Kerr and G. L. Malcolm.

P. M. King (Sandbanks) Ltd. 3.3.60. 175 Sandbanks Rd., Parkstone, Poole. To take over bus. of a drug store propr. cd. on as P. Osmond at 3 Bay View Bldgs., Sandbanks, Parkstone. £100. Dirs.: Percy and Phyllis M. Osmond.

Kingsley and Keith (Chemicals) Ltd. 1.4.60. £1,000. Dirs.: to be apptd. Subs.: A. N. Emanuel, 69 Gloucester Place, London, W.1., and Jack Franks, 21 Ely Place, London, E.C.1.

W. H. Messenger (Drugs) Ltd. 4.4.60. 52 Newborough, Scarborough. £1,000. Dirs.: W. H. and Mrs. K. M. Messenger.

Phyllis Scott-Lesley (Sales) Ltd. 4.4.60. Chemists, mnfrs. of and dlrs. in packed goods and proprietary medicines. £100. Dirs.: Phyllis Scott-Lesley, 57 Meadowside, Cambridge Park, East Twickenham, and P. S. Northam.

S. Allinson (Stocksfield) Ltd. 4.4.60. Runswick House, Stocksfield, Northumberland. To take over bus. of a pharmaceutical chemist cd. on at Stocksfield and Prudhoe by S. Allinson. £5,000. Dirs.: Sidney and Jean Allinson.

Jacksons (St. Austell) Ltd. 4.4.60. 3 Victoria Place, St. Austell. Chemists and druggists. £1,000. Dirs.: W. H. Williams and W. H. Williams, jr.

Alex Martin (Chemist) Ltd. 4.4.60. 22 Upper George St., Luton. £3,000. Dirs.: Alexander and Elizabeth A. C. Martin.

Oxley Pharmacy Ltd. 5.4.60. 468 Stratford Rd., Oxley, Wolverhampton. £2,000. Dirs.: R. T. G. and Mrs. L. M. Rylance.

Grecaux Ltd. 12.2.60. 62 Victoria St., London, S.W.1. Mnfrs. of and dlrs. in perfumes, cosmetics, etc. £1,000. Dirs.: M. J. and Ann R. Behrman.

Thames Alum Ltd. 16.2.60. £30,000. Mnfrs. of and dlrs. in aluminium sulphate, alumina, aluminium compounds, products and alloys, etc. Dirs. not named. Subs.: Alumina Co. Ltd., Iron Bridge Chemical Works, Widnes, Lancs., Aluminium Sulphate Ltd., 9 Basinghall St., London, E.C.2.

Hancocks (Bournemouth) Ltd. 16.2.60. C/o Alexander and Engel, 1 Gt. Winchester St., London, E.C.2. Dlrs. in and mnfrs. of drugs, cosmetics and toilet requisites, etc. £100. Dirs.: Herbert S. B. and Mrs. Norma G. Newman.

Fraser Chemicals Ltd. 17.2.60. 230 Empire House, St. Martins le Grand, London, E.C.1. £100. Dirs.: A. Fraser and M. Apor.

N. and D. Chemists Ltd. 17.2.60. 17 Church St., Blaydon-on-Tyne. £1,000. Dirs.: Dr. Joseph C. T. Roberts and Joseph M. T. Roberts.

Sixty-Five Years Ago

From MANUFACTURING CHEMIST
August 1895

Immunity and Immunising

Buchner and his fellow workers injected sterile emulsions of wheat gluten into the pleural cavities of dogs and rabbits, and obtained an exudate free of bacteria, but rich in leucocytes. This was more powerfully bactericidal than the blood or serum of the animals under observation. Inasmuch, however, as phagocytosis was a commonly observed phenomenon in the exudate, it became a question whether the destruction of the bacteria was due to it or to substances contained in the liquid. This question, of course, could not be answered simply by the microscope. It occurred to Buchner that freezing would destroy the vitality of the leucocytes, probably without injuring the bactericidal properties of the serum, and the consequently thawed serum would show whether the destruction of the bacteria was due to the serum or to the cells. The experiment was performed and the bactericidal Alexins uninjured while the leucocytes were killed. The serum after thawing was found to be just as powerfully, if not more powerfully germicidal than the unaltered exudate. (*Centralb. f. Bakt. und. Parasitenk; Univ. Med. Mag.*)

Manufacturing Chemist's **ENQUIRY BUREAU**

Leonard Hill House, Eden Street, London, N.W.1.

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